THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S).

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FATAL ACCIDENTS IN MINES.

ON the 24th ult. a public inquiry was held at Dunfermline with reference to the death of a miner at Hawkhill Colliery, Kincardine-on-Forth, who was killed by coming into contact with the hauling rope connected with an electrical coal-cutting machine. This rope was a flexible one, and was used for hauling the machine along the coal face, one end being wound on a drum fixed to the machine casing, and after passing around an anchored pulley, the other end was secured to the machine frame. The machine ran on skids, and the voltage was about 450.

From the evidence, as reported in the *Colliery Guardian*, it appears that a "bare" part of the conductor came in contact with the motor box, thus making alive the machine and the haulage rope attached to it. How the cable became "bare" could not be explained, but the inquiry revealed a lamentable state of affairs as to the men in charge of the machinery, and raised a question as to the meaning of a "competent person" according to Rule 11 of the Electricity in Mines Act.

According to the manager, the "competent men" appointed by him were the engineer of the colliery—who by early training was a blacksmith, but "he had been at engineering work for a period of about 15 years, and had managed electrical machinery and had helped to work it"—and, of all persons, "the oversman." None of the men working the machine had any knowledge other than a practical knowledge. The engineer inspected the machine on the manager's instructions twice a week; but here is the amazing part—"he was only supposed to examine the exposed part and the wires; there was no examination of the motor box," while the oversman, who is usually not even a skilled mechanic, had instructions "to open the casing enclosing the armature, also the switchbox, at least once a week, to see that everything was safe inside, and he got the engineer to do anything that was required," which means that the man who ought to have been responsible for the proper working and maintenance of the machine actually got his instructions from a person who cannot have had any mechanical or electrical training to fit him to carry out such a duty. The evidence of this man was that he "had had 10 years' experience both of working and inspecting electrical coal-cutting machines, and he inspected all the machines in the pit every day. He opened up the machine to get to the slate (of the starting switch). He could not get into the place where the defect arose without taking out the armature, and to take that out he did not consider part of his regular inspection duty."

There is no doubt that Rule 11, referred to above, is a little vague; it reads as follows:—"A competent person shall be on duty at the mine when the electrical apparatus or machinery is in use; and at such time as the amount of electricity delivered down the mine exceeds 200 B.H.P., a

competent person shall be on duty at the mine above ground, and another below ground. Every person appointed to work any electrical apparatus shall have been instructed in his duty and be competent for the work that he is set to do." The question is, what is meant by a competent person? If in the same mine a pony is taken ill, or loses a shoe, a veterinary surgeon, or horsekeeper, is sent for in the first instance, and a horse-shoer in the second. Why? Because they are fit and proper persons, or are "competent" to deal with the matter in hand. Then we may ask why is it not necessary to appoint skilled men to look after electrical plant? Why does not the oversman look after and physic the ponies, and fasten on their shoes when necessary? There is just as much reason to expect him to do this work as to examine and report upon electrical machinery.

There is no doubt that had the machine been examined as it ought to have been, the defect in the insulation would in all probability have been found, and the life of this man saved. Mr. M'Laren, H.M. Inspector of Mines, admitted so much, but added that "at the same time it might not." "He did not think that the oversman was entitled to take down the whole machine, because that was not reasonably practicable.

lectrical machines were being introduced, and the present year would witness a large addition to the number of them both in Fife and throughout the country. He wanted, therefore, to take the opportunity of saying that the owners and managers should see the necessity of having a competent person, with a technical knowledge, at all collieries where electrical apparatus was in use. He regretted to say that many of them read the rule as if anybody and everybody might be a suitable person under the rules. In every coal-cutting machine or motor such an accident might have been prevented if a system of a third wire or cable were introduced, and made to communicate with a proper 'earth.' If the death of that poor man had been the means of awakening managers and others to the necessity of keeping a competent man and also insisting on having these machines properly 'earthed,' the man had not died in vain."

The question of obtaining a good earth in mines is an extremely difficult one, as has already been pointed out in our columns, and there is no doubt that the only way to obtain a satisfactory "earth" is to use three cables or mains, a "positive," a "negative," and an "earth" wire. The latter would be connected to the "negative" bus-bar of the switchboard and to the frames of all the machines and switch-cases. Such an arrangement, however, is equivalent to forcing all our railway companies to run a pilot engine in front of every passenger train to prevent an accident to the latter, and is quite as reasonable. If electrical plant is properly installed, well insulated, and maintained so by competent men with an electrical training, even in "collieries" there ought not to be so many of these lamentable accidents, which, we regret to say, are becoming so common. It is complained that good colliery electricians are not to be obtained, which is no doubt true, but the reason is not far to seek, and may be very easily got over by offering better wages. Liability to accidents will exist, however, so long as the electrical plant is in the hands of oversmen and under-managers, who are "pitmen"; the very position they hold necessitates that they should be good "pitmen," and such men have no time to look after electrical or mechanical machinery if they are to do their other duties with that thoroughness which is expected of them.

The following incident will be received with a certain amount of incredulity, but is absolutely true and occurred at a Northumberland colliery. At this mine a number of pumps are used for draining dip workings, and are looked after, so far as starting, stopping, oiling, &c., are concerned, by the underground men. One morning an oversman went into the pit and found one of these pumps standing. It was out of order, and a man who had previously started the pump and found that it would not pump, owing to the valves being wrong, informed his superior (the oversman) of this fact, whereon the oversman started the pump, and on again being told it would not pump replied, "Nivor mind, the ————'s gannen, onyhoo!" And much the same sort of thing is going on with regard to electrical plant. The wonder is that there are not more accidents than those of which one hears.

The *personnel* of a colliery may be compared to that of a steamship; there is the manager with a first-class certificate, who ranks with the "captain," the under-manager with a second-class certificate as "mate," but there is no certificated "engineer." At large collieries a trained and qualified mechanical engineer is often employed, but there is often considerable jealousy and friction between the underground staff and the mechanical staff, due mainly to the fact that the "certificated" officials say they have the responsibility and will give the instructions, and unfortunately they do, to the owner's cost; and, until the law is altered and the mechanical engineer is recognised, and invested with the authority and responsibility which are his due, good men will remain aloof; or if a young man wishes to go in for a mining training he will choose the "certificated" position, rather than the "uncertificated" mechanical or electrical engineer's position. There is room, ample room, for improvement. When may we expect it?

Greenwich Observatory.

On Tuesday last the report of the Special Committee appointed last year, to investigate the vibration troubles set up by the L.C.C. tramways power station, was presented to the L.C.C. by the Highways Committee. Naturally, the Special Committee advocates turbine plant for the second portion of the generating station; but as this type had already been recommended by Mr. Fell a year ago, it was a foregone conclusion. The most important recommendation is that, when the turbine plant is available, the reciprocating engines in the older part of the works shall not be run after 10 p.m., or preferably, not after 8.30 p.m. It is also suggested that the two chimneys of the extension shall not be built higher than 204 ft. above Ordnance datum; the Highways Committee, however, is advised that it will be better to carry one of them to the full height of 271·88 ft., and to restrict the height only of the one which is on the meridian of the altazimuth. The gases discharged from the chimneys, it is suggested, shall not be much above 250° F. in temperature (as from the existing chimneys), and the station shall not be extended beyond the addition of plant of 20,000 KW. as now contemplated.

The Highways Committee appears disposed to meet the Admiralty more than halfway, suggesting only slight modifications in the proposals submitted, without affecting the results aimed at. The simple methods outlined in the report for overcoming the vibration trouble seem quite unobjectionable, and if these prove sufficient to effect their purpose, as we hope, all parties may well be congratulated on having found a very inexpensive and acceptable solution to what at one time appeared to be a very serious difficulty.

Appreciation of Science.

In the course of a leading article printed a few weeks ago, we had occasion to mention, with a good deal of pleasure, how numerous authorities on the subject of education were impressed with the manner in which a conviction of the enormous value of science is growing amongst members of the British nation. Since that article was published, corroboration of the views expressed has come from a totally unexpected quarter—no other, indeed, than the office of *Mr. Punch*. Putting on one side any reference to the high level of wit and humour invariably displayed by our unique contemporary, two features strike the readers of *Punch* every time they see that journal. These are, the manner in which *Mr. Punch* keeps himself in touch with all matters of current interest, and the way he satirises these matters without bitterness. In his issue dated February 6th we find a skit on modern scientific research. The article is noteworthy because its appearance shows that *Mr. Punch* believes a considerable number of his readers to be interested in matters of science to such an extent as to be able to appreciate his humour; but it is even more noteworthy because of the clever manner in which it castigates the modern kind of futile "research" which is instructive to nobody but the investigator, and does not benefit him much. The article is entitled "Annals of Physical Research on Commonplace Conceptions," and solemnly refutes the common notion that a watched pot never boils. Conclusive evidence is given that a watched pot does boil, and that, in identical conditions, a known quantity of water occupies invariably the same period of time in rising through a given number of thermometric degrees whether observed by Brown, Jones or Robinson.

Failure of Electrical Supply.

Upon occasions when the consumer is troubled by failure in the supply of electricity, he may be compelled to seek and enforce some remedy against the supply authority who have failed to perform their obligations. He may, of course, summon the company for penalties; but the penalties ordered to be paid are generally insufficient to compensate for the injury sustained. A recent case, however, serves to show that unless the provisional order authorising the supply is drawn in some peculiar way, this is the only remedy. The case in question is Morris & Bastert, Ltd., *v.* Loughborough Corporation ((1907) 71 J.P. 10), which was decided in the King's Bench on October 26th, 1906, and was briefly reported in the Electrical Review for November 2nd. It appeared that the defendants were empowered by the Loughborough Corporation Act, 1899, to supply electrical energy. The Act imposed upon the defendants an obligation to supply energy to owners and occupiers of premises within the area of supply upon their being required so to do, and Sec. 62 provided that "Whenever the undertakers make default in supplying energy to any owner or occupier of premises to whom they may be and are required to supply energy . . . they shall be liable . . . to a penalty." Penalties were recoverable summarily in manner provided by the Summary Jurisdiction Acts. Sec. 65 of the Act empowered the defendants to make agreements as to the price to be charged for energy. Under the power conferred by that section, the defendants entered into an agreement to supply energy to the plaintiffs for a certain period at certain prices. The defendants failed to supply such energy, and the plaintiffs thereupon brought an action in the High Court for damages for breach of the agreement. It was held (by Bigham, J.) that the penalty section applied in all cases where under the provisions of the Act the defendants supplied energy, and that no distinction could be made between cases where the supply was controlled as to price by virtue of an agreement, and that, therefore, no action for damages in respect of failure to supply could be maintained. Seeing that the provisions of the Act under which the above decision was arrived at, are similar in all material respects to the provisions of the Electric Lighting (Clauses) Act, 1899, this decision should be noted by all who are interested in the supply of electricity.

WIRELESS TELEPHONY.

By R. A. Fessenden.

1. *The Present Status of Wireless Telephony.*—Wireless telephony is now in reliable operation over a distance of something more than 10 miles, and stations are being constructed to operate between two cities 30 miles apart. Speech has been transmitted wirelessly from a sending station to a receiving station, and relayed from the receiving station to the local wire telephone exchange; the relays used for this purpose being the standard telephone relays of the Bell Telephone Co., and a somewhat similar form, which gives slightly better results for feeble sounds, designed by the writer. Speech transmitted from a wireless sending station has been received at a wireless receiving station and recorded on a phonograph.

The clearness of the speech received varies with the type of wireless telephone apparatus used. Where a spark is used at the transmitting end there is always more or less of a hissing or crackling noise in the receiver, which, though extremely disagreeable, is not enough to interfere with the transmission so long as the spark is properly adjusted. Where no spark is used for transmitting, and a carbon transmitter is used for modifying the strength of the waves, the speech is as distinct as over a short telephone line, and much more distinct than over lines containing cables, and there is a total absence of extraneous noise. When a condenser transmitter is used at the sending end the speech is much more distinct than over any wire telephone line, and, where a double telephone is used as receiver, produces a peculiar illusion, as if the speaker were talking in the same room as the hearer, and the room were covered with sound absorbing hangings, cutting off all reverberation or echo.

2. *The Future Prospects of Wireless Telephony.*—Telephony by wireless methods has a great advantage over the present methods, in that there appears to be no distortion of the transmission with increase of distance. This might, indeed, have been anticipated. It has, however, been experimentally demonstrated, by comparison of the relative intensities of notes of different frequencies at different distances.

There would appear, therefore, to be no reason why wireless telephony should not be operative over much longer distances than is possible in the case of wire lines. It is true that telephone relays are now in commercial use on a number of long lines; for instance, in talking from Boston to Cleveland it is customary to relay at New York or Troy, but these telephones relays do not improve the articulation, and merely increase the loudness of the speech, leaving the distortion unchanged, and, in fact, making it slightly worse than it is without the relay.

The difficult problem in wireless telephony is, of course, the modulation of the large amount of energy used for transmission. Where a carbon transmitter is used for this purpose, an ordinary transmitter will not successively modulate more than half an ampere of current, and even with special transmitter buttons 2½ amperes seems to be about the limit. With multiple buttons the limit is reached at about 10 amperes.

For currents larger than 10 amperes a number of telephone relays placed in series and operated by a single transmitter can be used. The limit to this arrangement is not yet known.

Where the telephone transmitter is used to affect the strength of the field of a high frequency dynamo, the amount of power which can be handled is less than 10 kw., on account of the fact that the self-induction of the armature increases very rapidly with the output. Where the transmitter is used to divert the magnetic flux, no limit has as yet been reached. The same statement applies to the case where a condenser telephone is used for affecting the resonance.

Up to the present, therefore, it is not possible to state what the limiting distance of transmission by wireless telephony is. It appears fairly certain, however, that there will be no difficulty in communicating between ships at least 200 miles apart, provided that they have masts at least 130 ft. high and are equipped with aerials of suitable capacity.

D

One advantage which the wireless telephone has over the wireless telegraph is that it does not require a skilled telegraph operator to operate it, and, moreover, it is not put out of work by atmospheric or other disturbances, since the speech is readily understood over the noise. The extent to which this is the case is shown by the fact that, as a rule, individuals who have listened to the wireless telephone for the first time, and are asked after they have removed the receiver from their ears if there was any atmospheric disturbances or interference, have almost invariably to replace the receiver to their ears before being able to answer the question.

This is, of course, only another instance of the well-known selective power of the human ear, which enables it to interpret speech over a wire telephone through disturbances many times the intensity of the transmitted speech.

It is doubtful whether wireless telephony will ever supplant the present wire local exchanges. The difficulty is not entirely one of selectivity, as though this is a sufficiently serious one it is not impossible, improbable as it may seem, to overcome it. The difficulty goes down to the basic fact that the most successful local system will be the one which is the simplest and least liable to get out of order. Now nothing, so far as the subscriber is concerned, can be more simple than the present central energy system, and it is not likely, therefore, that there will be any immediate future for wireless telephony in this field.

As regards long-distance telephony, however, the matter is a different one. Speech has already been actually transmitted to a wireless sending station, automatically relayed from the wireless sending station to a wireless receiving station, and automatically relayed again from the wireless receiving station out over a wire telephone line and heard with perfect distinctness.

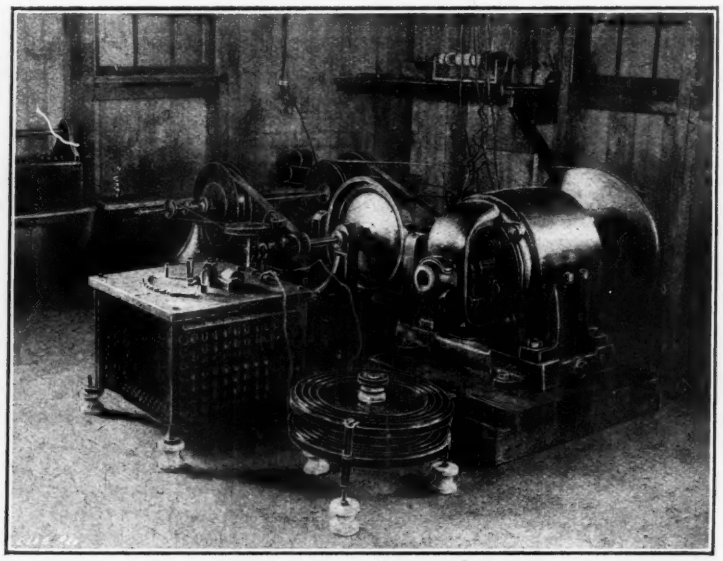


Fig. 1.—Generator of 60,000 Cycles Frequency.

In addition, messages of more than one frequency have been simultaneously transmitted, and a test will shortly be made, the success of which is not doubtful, on sending out speech from a wireless antenna, while at the same time receiving speech from another station on the same antenna.

The cost of a long-distance wire telephone line is considerable. The line must be of high conductivity and of the very highest class of construction. It is understood that some of the long-distance telephone lines in America have cost not less than $750.00 per mile. For a distance of 1,000 miles this means an expenditure of $750,000.

While at the present time long-distance wireless telephony may seem rather premature, those who are acquainted with the actual operation of the apparatus know that there is no difficulty in the way, provided sufficient power and capacity be used to overcome the effects of atmospheric absorption. In addition, the fact that multiplex telephones can be obtained between two wireless stations should be a great commercial advantage.

It is, therefore, not at all improbable that, in addition to its use on shipboard, wireless telephony will have a real commercial field in long-distance telephony.

Another disadvantage which wire telephone lines labour under is the effect of capacity. Relays cannot overcome this difficulty, and the use of the Heaviside-Pupin method has not, as yet, shown itself practicable for the transmission of speech by cable across the sea. Moreover, even if this were possible, the cost of a cable is even higher than that of the best-constructed landline, approximating $1,000.00 per mile. As the wireless telephone is not subject to these capacity effects, it is, in the writer's opinion, only a matter of time when wireless telephony will come into use for long-distance telephony across water.

Historical.—The development of the practical wireless telephone has been slow. In 1898 the writer made some tests which were entirely unsuccessful. At that time the only means for producing prolonged trains of waves was Lodge's method of using large inductance between the aerial capacity and ground. Tietz, at an early date, had used Leyden jars connected across the spark-gap, and later Braun described and used a Leyden jar and antenna sending circuit, in which the natural period of the Leyden jar circuit was specified as of a different and lower order than that of the antenna circuit (Braun English Patent 1862, A.D. 1899).

Neither of the above methods, however, gave the results desired, but the writer found that good results could be obtained by a local condenser having its natural frequency the same as the natural frequency of the aerial. This method, which was used by Prof. Kintner and the writer early in 1899, and was patented by the writer (U.S. Patent 706,735, December 15th, 1899) proved a fairly satisfactory method of producing the long train of oscillations, and has since come into extended use.

After making various tests with Wehnelt interrupters and other devices, from which more or less encouraging results were obtained, a mechanical make-and-break was constructed, giving 10,000 sparks per second when connected to an induction coil.

In the fall of 1900 intelligible speech was for the first time transmitted by electro-magnetic waves between two masts 50 ft. high and exactly one mile apart, at Rockpoint, Md.

In 1901 and 1902 experiments were made, using Elihu Thomson's method of producing rapid oscillations by means of an arc and shunted resonant circuit. Better results were obtained by a modification of this method, but there was still a very considerable amount of foreign noise in the telephone.

Meantime, work on high frequency alternators had been begun in 1900, and a 1-KW. alternator, giving 10,000 cycles per second, was completed for the writer by the General Electric Co. in 1902.

This frequency was, of course, not high enough for the direct production of electro-magnetic waves, but was used to operate a spark gap, it giving much better results than the rotating break. Measurements made at Washington in 1904 showed that a distance of 25 miles could be reached.

By the end of 1904 the wireless telephone was sufficiently perfected to be capable of commercial use for a number of purposes, and the apparatus was advertised by the National Electric Signalling Co., guaranteed up to a distance of 25 miles, and with ordinary heights of masts.

Leaving to one side the mention of a number of different types, which were tested with more or less commercial results, it was finally found that the best articulation was obtained by the use of a high frequency dynamo, used to generate the waves directly without any spark-gap. A photograph of this dynamo is shown in fig. 1. It is normally run at a frequency of 60,000 per second, and has an output of about ¼ KW. It has been run as high as

80,000 cycles per second, but there is then more or less danger of the results being vitiated from belt slipping.

In the later types of high frequency dynamo now being built, the driving is by gears, and it is anticipated that no trouble will be found in maintaining 100,000 cycles reliably. While this dynamo is of the general type described in U.S. Patent 706,737 (May 29th, 1901), the credit of bringing the design to a commercially successful stage is due to the engineers of the General Electric Co., more especially Mr. Alexanderson, Mr. Reist, Mr. Dempster and Mr. Geisenhoner.

As regards the degree of success that has been attained, it will be sufficient to say that the machine has operated for seven or eight hours a day for weeks at a time with hardly any attention.

(To be continued.)

producing a heavy racking strain on the spindle. Recourse is therefore had to the drum type of starter for motors which

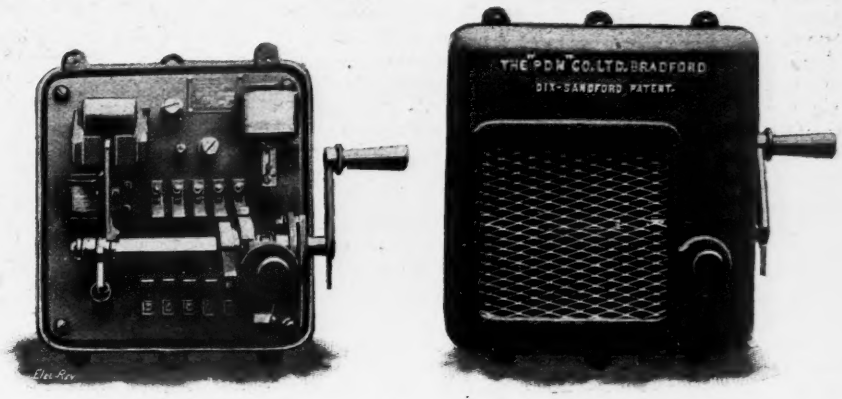


Fig. 1.

are frequently started and stopped, as this cumulative arcing trouble is not found in switches of this description in which each contact behaves independently of its neighbour, and the pressure, which has an important effect upon the current-carrying capacity, can be made large, as the forces are balanced.

The object aimed at in the helical drum starter is to provide a simple mechanism, easily adjusted or repaired, on the slow-motion drum principle, the component parts of which can be used in starters of different types. One novel feature of the design consists in the form adopted for the moving member of the switch, which is shown in figs. 1 and 2. This moving contact piece or helical drum has a single thread of $1\frac{1}{4}$ turns, and it is caused to slide along a square shaft when the latter is rotated. This effect is produced by a rack mounted upon the switch base, in which the helical contact piece engages, and is thus compelled to travel endways as if held in a complete nut. Novelty is also claimed for the device making it impossible for any part of the resistance to be left in circuit. The means for effecting this which have been used hitherto consist of a spring for pulling the switch lever across the contacts, and unless the latter are in good condition the brush is liable to stick in an intermediate position. The device described below is a distinct advance over the existing method in this respect.

NEW MOTOR STARTER.

So many different devices have been invented for the purpose of starting and stopping electric motors, that any radical departure from existing practice might be deemed well-nigh impossible.

The inventor of the "helical drum starter" has, however, introduced a method of switching which is essentially different to any at present in use.

The defects usually met with in starting switches

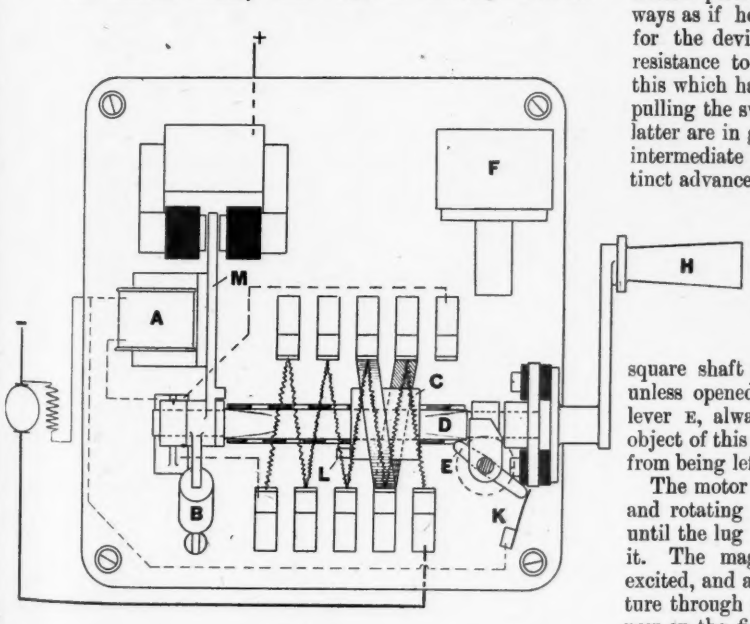


Fig. 2.

include:—Arcing at the contacts; burning out of the resistances; burning out or failure of the no-volt magnet; earthing of the resistance or wires connecting it to the switch. These troubles are not fully met by the radial flat contact type of switch, in which the damage to the contacts and brush caused by arcing may be called cumulative, that is to say, a blister on one contact tends to raise the brush and thus cause similar damage to the next contact.

This defect could be partially eliminated by increasing the pressure between the brush and the contacts, but such increase introduces a good deal of additional friction by

Describing the starter more in detail: in fig. 2, M is the magnetic blow-out circuit-breaker held in by the "no-volt" magnet A against the action of the spring B; C is the helical drum, provided with a lug L for engaging the circuit-breaker; H is the operating handle, insulated from the square shaft D; K is a small spring-actuated switch, which unless opened by hand, or by the helical drum striking the lever E, always short-circuits the "no-volt" magnet, the object of this switch being to prevent the starting resistance from being left in circuit.

The motor is started by holding K open with the left hand and rotating H with the right in the clockwise direction, until the lug L engages with the circuit-breaker and closes it. The magnet A and the motor field have now been excited, and a current is passing through the motor armature through all the starting resistance. The starter being now on the first stop, the starting is continued by rotating H in the counter-clockwise direction until all the resistance is cut out and the motor brought up to full speed. If the attendant leaves the switch partially on, K comes into action and prevents damage to the resistance, by opening the motor circuit.

The motor is stopped by giving H a quarter-turn clockwise, thus releasing K and causing the circuit-breaker M to operate.

The device F, which operates by short-circuiting A, protects the motor against an overload during starting-up or when running. The mechanical slow motion of the starter prevents too rapid starting, but if an overload should be forced on the motor before it is up to full speed the

motor circuit is opened through the action of the overload device.

As the circuit-breaker can only be closed by the helical drum in a position where all the resistance is in circuit, the closing of the starter with any part of the resistance cut out is prevented. The stroke of the circuit-breaker being a short one, its spring requires to be only of moderate strength, and this enables the no-volt magnet to be wound with a good margin to allow for the variation in the shunt current of motors of different make. Its liability to get burnt out is therefore decreased.

Damage to the insulation of the motor by opening the shunt circuit is guarded against by always keeping this circuit closed through the motor armature and starting resistance, in the usual way. Full field excitation is obtained during the whole time of starting, as the exciting current never passes through the starting resistance.

Practical experience with this type of switch shows that the long self-cleaning motion of the helical drum on the contact fingers, the tight contact between drum and fingers, the continuous switching action without the probability of

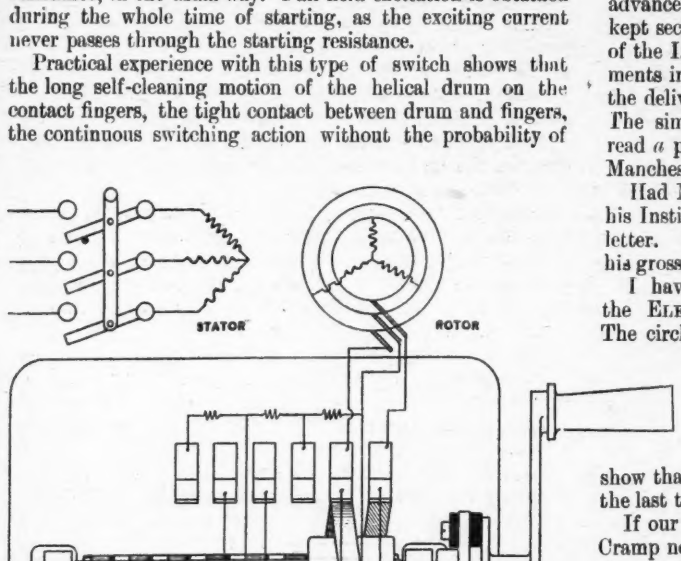


Fig. 3.

making uncertain contact when passing from one step of resistance to the next, and the fact that all breaking of current is done at a point protected by a magnetic blow-out, cause the switch to work without any harmful sparking.

The resistances are of the unit type with the resistance material supported and protected throughout its length. The units being fixed to a cast-iron frame independently of the resistance box, can be easily examined or replaced. Porcelain insulation is used, and as no soldered joints are employed and it is protected from oxidation, the resistance material can be allowed, on emergency, to get red hot without being damaged.

Fig. 3 shows how the standard component parts are used for building a rotor switch for starting induction motors.

This starter is being made to the designs of Mr. H. W. W. Dix by the Phœnix Dynamo Manufacturing Co., Ltd., of Bradford, who are the sole manufacturers, and the patents are owned by the designer and Mr. J. Sandford, of Birmingham. It will be remembered that a description of the starter, in its original form, was published in our issue of August 19th, 1904, p. 289.

Swansea Telephones. — The negotiations for the transfer of the Swansea municipal telephone system to the National Telephone Co. have been completed, the company having agreed to accept the Corporation's terms for repayment in full of the capital expenditure, and also certain stipulations as to the service of present subscribers. The precise terms of the settlement are under consideration.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Cramp Neutralised Repulsion Motor.

I have no doubt, as Mr. Cramp says in his letter in your issue of February 8th, that the meeting at which he read his paper was well advertised, but that is beside the point. The mis-statement of which I have convicted Mr. Cramp, and which is so strongly personal, was not advertised, nor was an advance copy of the paper sent to me. My address is not kept secret, and is, for instance, given in the list of members of the I.E.E., dated August 31st, 1906. The postal arrangements in this country are also sufficiently reliable to ensure the delivery in London of a letter posted in Manchester. The simple fact of knowing that Mr. Cramp was going to read *a* paper was hardly likely to induce me to journey to Manchester for the auspicious occasion.

Had Mr. Cramp not introduced the personal element into his Institution paper, he would not have found it in my last letter. In any case, I am still waiting for an explanation of his gross mis-statement.

I have shown at the time that Mr. Cramp's diagram in the Electrical Review of May 11th, 1906, was wrong. The circle diagram in the Manchester paper applies to a series conduction machine, and has no reference to the shunt conduction machine under discussion.

It is quite easy for Mr. Cramp to satisfy me. Let him either *prove* that my contentions are incorrect, or give unequivocal results of tests to show that the claims so boldly put forward, for instance, in the last table of his paper, are justified and fulfilled.

If our difference is reduced to a question of degree, as Mr. Cramp now states, then it is because he has altered his views since reading his Manchester paper.

Mr. Cramp has, of course, obtained nothing like the ratio $\phi_3 : \phi' = 3 : 1$ of which he speaks. His test, when correctly interpreted, only confirms my view, that, at no load, ϕ' may be comparatively small, but that ϕ' increases very rapidly as B is loaded. See my letter of January 21st under 3. With B on open circuit $\phi_m = \phi_o'$, on load $\phi_m = \phi_l' + \phi_3$ where ϕ_l' is much greater than ϕ_o'. Mr. Cramp has probably measured $\phi_m = \phi'$ with B open, and found (*a*) $\phi' = 1{\cdot}8 \times 10^5$; then he measured ϕ_m at full load and found (*b*) $\phi_m = 7{\cdot}8 \times 10^5$; he then *assumed* ϕ' to be the same, whether B was loaded or not, and subtracting (*a*) from (*b*), he got $\phi_3 = 6 \times 10^5$.

The fallacy of this proceeding is really too obvious. It is not possible to find ϕ_3 by a direct and simple measurement of ϕ_m, and without taking the phase conditions into consideration. An indication of the values of ϕ' can, however, be obtained by measuring the terminal volts of B with B on open circuit and when loaded, whereby it is necessary to keep the armature stationary. The drop in volts will indicate the reduction of ϕ'', and, therefore, the increase of ϕ'.

I notice that Mr. Cramp now discards the neutralising winding N, which formed part of his original scheme; that alone shows that my contentions are correct. The neutralising winding improves the power factor, but as soon as the latter rises, then the torque per ampere in Mr. Cramp's motor must diminish. N is, therefore, detrimental, as I stated long ago.

It is worth noting in this connection that ϕ_3, which is admittedly of the same phase as I_2 can only materially affect the phase of ϕ_m, if ϕ_3 is in quadrature with ϕ. This can only be the case, however, when the power factor is unity. Unity power factor cannot be obtained without N. Supposing now that it were possible to increase ϕ_3 sufficiently to make it equal to ϕ', then even if the power factor were unity, ϕ_m could only differ from ϕ by 45° at most. In this motor a good power factor is incompatible with a reasonable torque per ampere.

It seems to me incomprehensible how Mr. Cramp could have computed the last table of his paper, if he is not even now able to give approximately correct data of the actual

performance of his motor. His table is so very misleading, that I venture to ask you for a little more space in order to draw attention to the incorrect statements contained therein.

The term "compensation coils" probably stands for "neutralising winding," *i.e.*, a winding neutralising the armature ampere-turns. In that case the "simple series motor" in the first column is what I call the "neutralised series conduction motor."

The only motor I can think of to fit the heading of the second column is the same machine as under I, but connected to the mains through a reducing transformer. There is no series conduction machine in which the transformer is embodied in the motor itself. That being so, I fail to see why II should be more difficult to wind than I, even if the outside transformer is considered, for a transformer is the easiest possible apparatus to wind for any ordinary high voltages. Then why should II not require a neutralising winding? Has Mr. Cramp, or anybody else, ever seen an alternate-current motor of fair output for weight, and with a good power factor, but without a neutralising winding? The thing is an impossibility; besides, since II is the same as I, and if I requires a neutralising winding, why does II not require one as well?

I assume that by "repulsion motor" in column three is meant a "separately excited series induction motor." Since the table takes no account of periodicity, a comparison between I and III is difficult, for while I is suitable for low cycles up to, say, 25, III is suitable for, say, 25 to 50 cycles. Then, again, I is best at a speed exceeding the synchronous by, say, 40 per cent., whilst III is best at a speed a trifle above the synchronous. In order to get at least some ground of comparison, let us take throughout 50-B.H.P. motors at 25 cycles, and compare the various motors at full load and at their best speed. Then the power factor for I and II may be taken at ·9 (for 15 cycles ·95 is nearer the mark), for III the power factor may be taken as ·9 or just under. For I and II the power factor goes on increasing with the speed, for III it soon begins to drop again. At the speeds we are considering, commutation is excellent in all three machines; it becomes less good in all three as the speed decreases.

In column three, Mr. Cramp states that the series induction motor requires no neutralising winding. This is an astounding assertion. It should be well known by now that *any* induction motor is neutralised *ipso facto*. The efficiency is another important factor which is not taken into account in Mr. Cramp's table. The commercial efficiency of motors, such as I and III, and under the conditions stated, may be taken at 80 per cent. It is no use my criticising the iron and copper weight figures, for to judge by one of Mr. Cramp's last letters, he must have simply guessed at these items.

I note that the table in question places on record that Mr. Cramp's motor will have a power-factor of at least ·9, will commutate better than a neutralised series conduction motor wound for low voltage, and may be operated directly from a high-tension supply. Further, that the weight of his motor will not exceed that of a corresponding separately excited series induction motor by more than 20 per cent., that it will not require a neutralising winding, and will have an efficiency at least equal to that of I and III.

I say that these conditions will never be fulfilled, nor even approached, by Mr. Cramp's motor; his motor cannot stand any comparison whatever with any motor now on the market.

Val. A. Fynn.

London, S.E., *February 8th*, 1907.

The Appointment of Municipal Electrical Engineers.

I should be glad if some of your readers, who happen to be members of electricity committes, would kindly condescend to supply, through your columns, some information regarding the most important qualifications they consider it necessary that a person applying for the post of chief engineer and manager of an electricity supply undertaking should possess. Also upon what basis these appointments are usually made.

In years gone by the consideration of an applicant's suitability for any particular appointment usually involved some consideration of the applicant's general business experience, and his length of service in responsible positions, but nowadays with a great many committees, more especially the committees in the smaller towns, both of the above qualifications appear to be of very secondary importance indeed, even if worthy of consideration at all, and much greater importance seems to be attached to some other kind of qualification at present unknown to me, but which I am anxious to be made acquainted with, hence this inquiry.

By reason of some mean and underhand tactics on the part of several members of an electricity committee, under whom it was recently my sad lot to work, it has been my misfortune to have to seek a new appointment on account of my not being willing to accept a salary about one-third less in amount than the original salary on which I was engaged, and which original salary was, from the wording of the advertisement inviting applications, to be a permanent, if not an increasing one.

The results which have attended my efforts during the past two months or so to secure another appointment have made it perfectly clear to me, that something more than years of experience in responsible positions and general business qualifications are required in order that a candidate may be successful in his application.

One would think when a post was advertised in the public Press that it was the intention of the persons advertising to throw the appointment open to competition, and that it would be the aim of the advertisers to secure the best man they could get for the salary offered. In how many cases do we find this so?

Take the result of my latest venture, which result may be taken as a fair sample of about six others I have experienced during the past two or three months. The position was that of chief engineer to the Council of a small town in the south of England.

The commencing salary was about £100 a year less than the amount I had been receiving, but as the salary was a progressive one, and a further advantage in the way of a pupil was allowed (although I may say I do not altogether believe in an engineer being paid by allowing him to take a pupil), and as half a loaf is better than none at all, I applied for the appointment. The principal qualifications required were that in addition to the candidate being experienced in the management and control of an electricity works, he was also required to have a knowledge of, and be experienced in, preparing plans, specifications, &c., for the extension of plant and mains.

My application was unsuccessful, but with all deference to the abilities of the successful candidate, I have no hesitation whatever in saying that my general experience in connection with electricity supply works has been, at the very least, three times the experience of the successful candidate, and in general business matters I dare say I have had six times the experience. On what basis, therefore, was this appointment made?

Whatever method of dealing with candidates' applications is adopted by committees, it is perfectly clear that the applications are not read as carefully as they should be, and the candidate's qualifications are not really gone into, or very different decisions would be come to in a number of cases.

I enclose you a few papers relating to the appointment spoken of above, to enable you to judge as to my qualifications for the post.

W. H.

[Our correspondent's qualifications appear to be unexceptionable, and his case is but one of many such. The extraordinary selections sometimes made are to us inexplicable—on technical grounds; as we have no information regarding the case now in question, we refrain from reference to other possible explanations.—Eds. E.R.].

The Lighting of Oxford Street.

While in London recently I took the opportunity of inspecting the new installation of flame arcs in Oxford Street, and am, therefore, not a little surprised to read Mr. F. A. Goodenough's letter in the current issue of the Review, *even though it is written by a gas expert.*

Mr. Goodenough says the cost of electric light is now £1,675, while the cost of the former gas (lighting) was

only £550 per annum. Possibly so, but seeing that there is now about one hundred times more light than formerly, it is easy to see that even Marylebone Councillors have their lucid moments.

Mr. Goodenough next complains that half the arc lamps are extinguished at 12.30 a.m. Of course they are, and even then the lighting is immeasurably superior to the former or any possible system of gas lighting.

One can only admire the letter of Mr. Goodenough as being the last weapon of the champion of a losing cause.

No, Sir, gas is not "goodenough" for Oxford Street.

W. J. U. Sowter.

Electricity Works, Bray,
February 9th, 1907.

A Kingston Wiring Contract.

We notice in your issue of 8th inst. a paragraph headed "A Kingston Wiring Contract."

We made no mistake in our tender. The contract is well on towards completion, and we are satisfied that our figures are coming out according to estimate.

As you notified in your issue of January 25th, 1907, that our tender for the contract in question was accepted we must ask you to give equal publicity to this.

We may state that we do not tender for work excepting upon remunerative terms.

Prestwich and Burt.

Kingston-on-Thames, *February 9th*, 1907.

Electricity and Destructor Works.

Either Mr. Maxwell's letter was an excuse to trot out last year's destructor figures, or he did not read through my article, where I distinctly stated that the Partick destructor records which I gave were "rather ancient." Rather ancient does not mean "for the last completed year." I maintain that my figures were quite correct. Perhaps Mr. Maxwell can prove otherwise, if he gives us his destructor figures for the first three years' working?

As regards his figures for the last completed year, they are absolutely useless, and he cannot hope to disprove the statements, I made in my article, unless he adds the following information, *i.e.* :—Units generated by coal for last completed year; units generated by refuse for last completed year; cost of coal for last completed year; cost of refuse steam for last completed year.

Is the Partick destructor robbing its now prosperous partner the electricity works in order to hide its shame? If so, we may yet hope to see Partick burning refuse at a labour cost of 10d. per ton, as could easily have been done had the destructor been placed away from the electricity works.

A. J. Abraham.

Cambuslang, *February 9th*, 1907.

Metallic Filament Lamps.

I note "Inquirer's" remarks, and beg to inform him that it is quite possible to make such a composite lamp as suggested—*i.e.*, metal and carbon. I made several over two years ago. I purchased some tantalum lamps, took out the wire, and remade it in several ways—such as by interposing strips or rods of carbon filament in series with the tantalum wire filament—and when lighted it was very difficult to tell which was carbon; also I made twisted curls, rings and other forms. They all answered excellently, with an efficiency of 2·2 per candle downwards, according to the efficiency of the carbon filament.

I also treated the "osmi" filament in a similar manner, and was more successful, as the carbon limb supported the "osmi" filament, and it could be burned in any position; the carbon really acted as a luminous supporting resistance to the osmi.

Metal filaments are not new, nor is the compound (metal and carbon in series), see Woodhouse & Rawson patents No. 1,412 of 1882, and a published provisional specification by D. G. Fitz-Gerald, No. 5,275 of 1880.

About 18 years ago I made carbon filaments coated with metal oxides, &c., also compounds producing excellent filaments, but these experiments are rather costly, and unless one has a really healthy account at the bank, it is unwise to go on. It being a very speculative pursuit, the average British financier does not care to lend his support, hence the German or American who is speculative reaps the benefit, if any.

F. Harrison.

London, N., *February 8th*, 1907.

I have much pleasure in replying to your correspondents, Mr. Horsfall and Mr. Hewitt, and in giving them some further information, which I hope will be satisfactory. I quite appreciate that one might well be sceptical as to such a really remarkable result; but, nevertheless, I can speak to the veracity of my statements, and the practical accuracy of my figures.

The reason these lamps are not universally used is that, at present, they are hardly known, and have been difficult to obtain. Contractors are wisely slow in pushing new things until they have time to ascertain if they may be fully recommended to their customers. The lamps in question were tested individually for consumption on the same sensitive ammeter, and also in separate batches on the same meter.

The candle-power, I take it, is correctly marked on the Ediswan lamps, but when comparing the two lots, side by side, there is a far greater difference in the amount of light, in favour of the Osram, than would be accounted for by the very slight inequality of the aggregate candle-power of the two batches. If the readings on the lamps were correct, there should only have been a difference of 16 c.p. The Osram lamps are still burning beautifully—the Ediswan, which I am now replacing with Osram, are looking very dim.

If the consumption according to my ammeter was wrong, it was so in both cases. I have, however, no reason to doubt its accuracy. The lamps used were in neither case special test lamps. I consider the Royal Ediswan lamp one of the best of the carbon filament lamps.

My report was not based on minute scientific tests, but is a practical one, which will convince consumers, if not those with a highly technical knowledge.

R. N. Cunningham.

London, W., *February 11th*, 1907.

When a public man gets up in all the glory of his official title, and drags in a subject which was not referred to in the paper under discussion, one sees the grindstone, and naturally looks for the axe. If Mr. Boot thinks his recommendation is of interest to other engineers, he must know that it will be equally interesting to them to know what amount of bias attaches to it.

Of course, had Mr. Boot kept nothing back he would not have been so anxious about my identity, but would have taken the opportunity of demonstrating his singleness of purpose. As it is, no one will be deceived by his very ancient method of evasion. And how childish his reference to legal advice!

Nothing Like Leather.

Wireless Telegraphy and the Admiralty Agreement.

There can be no legitimate doubt that Mr. Cuthbert Hall is perfectly entitled to treat all who venture to differ from him in opinion as fools and knaves, the biggest of them being the correspondent who ventures to point out the bare unpleasant fact that the Admiralty agreement with the Marconi Co. has freed the Admiralty from the obligation to buy any more "parts" from the company except certain jiggers and jars. A fortnight ago I pointed out for Mr. Cuthbert Hall's edification, and for the interest of your readers, that the Admiralty is, for example, procuring coherers from other parties than the Marconi Co., and is exercising thus its dearly-bought freedom. Faced with this unpleasant revelation, what does Mr. Cuthbert Hall say? Being unable to deny it, in fact, without telling a lie, and being unable to tell a lie by denying it, he adopts the usual Cuthbert Hall tactics of observing that the statement is

made by a mere man in the street, a correspondent without even a name, who may therefore be safely abused. Abuse, if it were tenfold more violent, would not alter the facts. There they are, no matter whether the man who points them out is the greatest scoundrel unhung. I am, indeed, a miserable sinner. But for all that I am still able to read. So I have been reading the Admiralty agreement over again, and very pretty reading I find it, particularly Clauses 11 and 12. For, strange as it may seem, in spite of all Mr. Cuthbert Hall's denials, that agreement, having never been abrogated or cancelled, is still in force. Strange to say, the Admiralty still continues to pay, and stranger still the Marconi Co. still continues to receive, the consolation money of £5,000 a year ("payable on or before the 30th day of April each year") as agreed in the very clause (No. 5) which secured to the Admiralty the liberty *at all times* to purchase from other sources such apparatus for wireless telegraphy as was not enumerated in the schedule of jiggers and jars; that is, liberty to procure any spare parts, coherers, relays, detectors, induction coils, &c., from any makers it pleases to patronise. At all times, mark!

Your readers will certainly be pleased to learn of the latest achievement of the Marconi Co., and of its rapid strides to prosperity, as announced in an advertisement I have just clipped from the columns of a contemporary; wherein it appears (now after its nine years of arduous labour in the face of all obstacles and in spite of foreign competition) that the Marconi Co. is now in a position to supply from its factory at Dalston, Wheatstone bridges of the Post Office pattern. How the long-suffering shareholders must rejoice at this final and triumphant discomfiture of

Your Correspondent.

Trade Prices.

With regard to Mr. R. A. W. Lance's letter in your issue of this week, stating that he has received a large postcard from a firm in Birmingham illustrating many accessories, &c., and listing them at wholesale prices, will you allow us to say that no postcard of this kind has been sent out by us. Our works being in Birmingham, some firms in the trade might think the card emanated from us; but not those, we are sure, who know the very strong views we hold with regard to protecting trade interests.

Veritys, Ltd.
M. B. Cotterell, *Director.*

Birmingham, *February 11th*, 1907.

Commutator Insulation Defects.

I have been very much interested in the discussion which has been carried on through your columns *re* the use of micanite in commutator construction.

My own experience thoroughly endorses the remarks made by Mr. Longridge, Mr. Sheppard and others, that pure mica is very much to be preferred to micanite. I quite agree with Mr. Vickery that there is such a thing as bad micanite, and to my sorrow I can bear testimony that it is sometimes used.

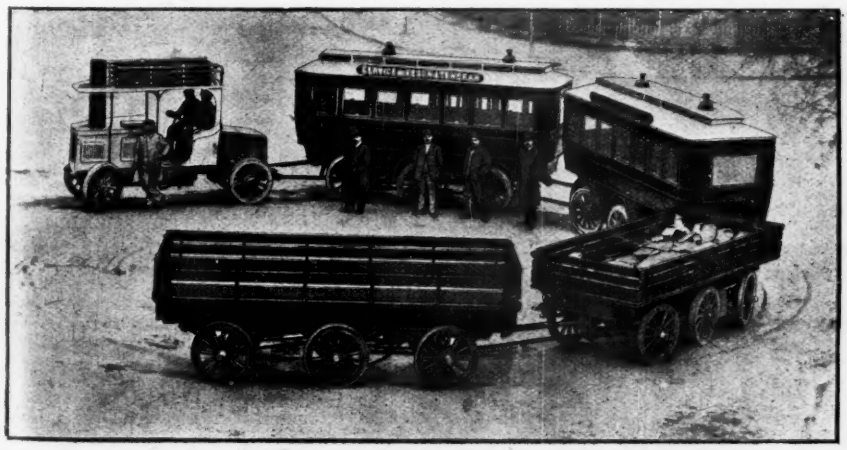
To give only one of the instances that have come under my personal observation:—We have four practically identical traction generators, one of which has persistently given trouble through defective micanite insulation between the commutator bars. The trouble occurred intermittently for several months, and on each occasion the micanite segments were replaced by pure mica. Altogether about 150 segments out of 558 have been insulated with pure mica, and since the last repair, several months ago, the machine has been running without the slightest hitch. I may add that this particular machine was supplied about twelve months after the other three, and I am convinced that the trouble was due entirely to the inferior grade of micanite which was used in the commutator construction. Oil had nothing to do with the trouble, as special precautions were taken to keep oil splashes from getting on to the commutator.

A. Taylor,
Assistant Borough Electrical Engineer.

Durban, Natal, *January 18th*, 1907.

THE RENARD TRAIN.

The accompanying illustration shows something of the flexibility of the Renard train of vehicles. This train is a French invention, and consists essentially of a leading vehicle which carries the motive power and a number of trailing vehicles, each of which carries a length of shafting geared to the wheels. Any reasonable number of vehicles can be coupled up to form a train, and they are self-propellant. They owe nothing to the tractive effort of the leading vehicle, but acquire their automobility from power transmitted through the universally jointed shaft which runs the whole length of a train of vehicles. The leading vehicle requires to be of no greater weight than is necessary to carry the motive power plant; no weight need be added for adhesion purposes. One of the great difficulties with traction engines of the ordinary type is that they cannot be run over many of the bridges in the country. The Renard train has no such heavy vehicle, and is therefore suited for all such work. The different vehicles are so coupled up that as each vehicle takes a curve it places the axles of the next following vehicle radially to the centre of curvature by means of specially devised linkwork. These trains are already at work in France, notably for agricultural produce carriage in the country and round Boulogne. Vehicles can be picked up and detached at farms or villages, and the amount of capital locked up in each vehicle is small, for there is nothing but a length of shafting and the necessary gearing to the axles, which are driven through a spring coupling in order to avoid shock, the spring being a helix coiled inside a drum. Each vehicle has six wheels, the middle axle, of course, being fixed, and the extreme axles arranged to place themselves radial to the curvature of the path followed by the leading vehicle. A train may be run either way indifferently, only the leading vehicle being steered, and the motor vehicle will supply power equally well from either a leading or a trailing position. Mr. B. H. Thwaite is the consulting engineer in England to the company. A demonstration of the system is to take place at Walham Green this afternoon.



The Renard Train.

Extensions at Dick, Kerr's Works, Preston.—In order to meet the very large demand for electrical plant, which exists both at home and abroad, the directors of Messrs. Dick, Kerr & Co., Ltd., have decided to carry out considerable additions to their Preston Works, this being the second extension which has taken place since the shops were erected.

LEGAL.

Bellamy v. Wakefield and District Light Railway Co.

In the Chancery Division of the High Court on Friday, Mr. Justice Joyce again had before him the motion by Joseph Bellamy, manufacturing confectioner, of Wheldale Mills, Castleford, to restrain the Wakefield and District Light Railway Co. from committing a nuisance by emitting smoke of petrol from their electric power station at Castleford.

Mr. Younger, K.C., for the defendants, said they used oil engines for generating the power for working electric tramways. Plaintiff complained that the fumes from the petrol engine seriously affected the health of his workgirls, and that the smell was continuous day and night except between the hours of midnight and 4 a.m. Defendants said that the complaint was due to the emission of fumes from the exhaust pipe. That pipe had been raised 10 ft., and the defendants said that the plaintiff exaggerated the nuisance. Two affidavits had been filed on behalf of the plaintiff, and these were to the effect that builders were of opinion the nuisance could be got over if a brick chimney were erected to a height of 80 or 100 ft. The engineers on behalf of the defendants said the emission of the fumes was due to the load on the engines being variable, and unless great care was taken to regulate the speed there was a tendency for disagreeable fumes to escape. The engineer was of opinion that the difficulty could be effectively got over by inserting a valve, which would enable the engines to be more regularly governed, or that certain electric accumulators should be adopted. The work would cost about £1,700 or £1,800. Defendants were willing to meet the plaintiff in a reasonable way. They were willing to erect the chimney to the height suggested, although it would involve an expense of £240, and to use every effort to prevent any alleged temporary nuisance. He suggested that the motion should stand over till the chimney was erected.

Mr. Owen Thompson, for the plaintiff, said the nuisance had been going on since October last. His evidence was that the workpeople had been poisoned by the fumes from the defendants' engine. He contended he was entitled to an injunction. The defendants were using the wrong sort of plant. They carried 50,000 passengers a week.

Eventually it was arranged that the motion should stand over till a convenient Saturday early next sittings, and that in the meantime the defendants should build a brick chimney 100 ft. high, and minimise the nuisance as far as possible.

Sinnock v. Burgess Hill Electric Supply Co.

At Hayward's Heath County Court, last week, Thomas Sinnock, of Burgess Hill, claimed £49 8s. 1d. from the defendant company for services rendered as former secretary, and for use of room, lighting, heating, telephone, typewriting, and clerk's assistance. Mr. R. Harker, who appeared for plaintiff, said it was largely through Mr. Sinnock's instrumentality that the company was floated, and he had devoted practically the whole of his time to his duties as secretary of the company. When he was appointed as secretary, his salary was to be fixed at a subsequent date, and although items had appeared on the agendas for the directors' meetings to fix the secretary's remuneration and office rent, the matter had been deferred. He had been paid certain money on account and for promotion fees. The chief defence was that the secretarial work had not been properly done, and that plaintiff was amply paid for his services by what he had received and the amount paid into Court. His Honour came to the conclusion that the sum offered by the company was sufficient to remunerate plaintiff for his services. He gave a verdict for the plaintiff for the amount paid into Court (£15 14s. 6d., which, with credit allowed by the plaintiff company, practically amounted to £20), and judgment for the defendant company, with costs, since the payment in, the money paid in to remain in Court as security for the costs.

Lloyd's v. Marconi International Marine Communication Co. and the Marconi Wireless Telegraph Co., Ltd.

In the Chancery Division of the High Court on Monday, this case came before Mr. Justice Kekewich, when it was announced that the action had been discontinued against the last named defendants. The question arising in the action, was whether on certain agreements entered into between Lloyd's and the Marconi International Marine Communication Co., the defendant company were bound to establish the Marconi system of wireless telegraphy on Lloyd's station at the North Foreland. Although there were other questions involved with the case, that was the main question of dispute. In the course of the opening statement by Mr. P. Ogden Laurance, K.C., on behalf of the plaintiff. His Lordship said that it was a case in which a settlement might well be arrived at. In the result, the further hearing was adjourned in order to enable the parties to endeavour to come to a settlement.

The case again came before his Lordship on Wednesday, when it was announced that negotiations were still proceeding. It was understood that the case would again be mentioned on Thursday.

Sargent v. L. Lumley & Co.

In the King's Bench Division, on Monday, February 11th, before Mr. Justice Phillimore, Mr. John Sargent, an electrical engineer, trading as Messrs. John Sargent & Co., of London, sued Messrs. L. Lumley & Co., of 1, American Square, Minories, bar fitters, &c., for £315 0s. 10d., balance alleged to be due in respect of work and labour done, and materials supplied. Defendants paid £250 into Court, and whilst denying liability, submitted that that was sufficient to meet plaintiff's claim, and counterclaimed £180 14s. 8d. The case was fought on the counterclaim.

Mr. English Harrison, K.C., and Mr. Ernest E. Wild were for the plaintiff, and Mr. Arthur J. Walter, K.C. represented the defendants.

The defendants in 1904-5 executed a quantity of work at the Gaiety Restaurant, then in process of equipment. The Gaiety Co. required some refrigerating machinery installed at the restaurant, and the defendants asked the plaintiff to undertake the work; a contract was entered into accordingly on December 17th, 1904. The plaintiff was to supply, deliver and erect an electric motor capable of driving the refrigerating plant, and to supply accessories in a properly insulated condition. Before entering into the agreement, the plaintiff, defendants submitted, had frequent interviews with Mr. Maitland Lumley, the managing director of the defendant company, and Mr. Adrian Collins and Mr. Nobile, the engineer and manager respectively of the New Gaiety Co., and he had also inspected the restaurant. The plaintiff applied a Taunton motor of 7 B.H.P., at the price of £59, and the defendants complained that it proved of insufficient power to drive the refrigerating plant without undue pressure; it had to be continually over-loaded, with the result that the armature was damaged, and that unequal resistance in the windings, bad sparking, and wearing of the commutator bars were caused. This obliged defendants at the beginning of June, 1905, to supply a 3-B.H.P. motor to relieve the 7-B.H.P. motor as a temporary make-shift, and on or about July 21st, 1905, to replace the 7-B.H.P. motor with a 12-B.H.P. motor. Plaintiff, on the other hand, declared that he informed the defendant that he had no personal knowledge of the Taunton motor, and quoted for it at the request of the consulting engineer of the defendants' principals, the New Gaiety Restaurant and Hotel Co., Ltd., and gave a guarantee in respect of a breakdown from defective material or workmanship. He also guaranteed a temperature rise not to exceed 70° F. after six hours' run at full load. There was, plaintiff maintained, no other warranty, expressed or implied. For the purpose of working the refrigerating plant water was used to cool the apparatus, and, at the normal temperature of London water, which he maintained was 60° F., the maximum H.P. required to drive the plant was under 7 H.P. Without notice, the defendants, however, used the motor to drive the refrigerating plant with cooling water at an abnormal temperature rising as high as 78° F., thus injuring it by overloading it continually. Plaintiff also alleged that the defendants negligently ran the refrigerating plant. Defendants, on the other hand, denied that they were under any obligation to supply water to the condensing tank at a temperature not exceeding 60° F., and pointed to the fact that it was not until June that anything was said about the temperature of the water. The condensing tank was supplied from the mains of the new London Water Board, and it was well known that in the months of June, July and August the temperature of the water in the mains was considerably more than 60° F.

Evidence was given by a number of witnesses.

On Wednesday, his Lordship, in giving judgment, said he thought the defendants were entitled to succeed on the counter-claim to the extent of £160, and, as they had paid into Court more than was necessary, they would have the balance out and must have their costs since the date of payment into the Court.

Judgment was accordingly given for the plaintiff on the claim for £364 odd, with costs up to the date of payment into Court by defendants, and for defendants in the counter-claim for £160, with costs since the date of payment.

Stewart v. North of Scotland Electric Light and Power Co.

In Forfar Sheriff Court, Alexander Stewart, wine and spirit merchant, Brechin, sued the defendant company, Montrose, for the sum of £32 12s. 10d. He alleged that, while laying their cables in Brechin, defenders, without his knowledge and in breach of their statutory obligation, unlawfully removed part of the trap on one of his drains and laid their cables through the remaining portion of the trap. The defenders in the same way, he alleged, unlawfully broke through another drain, laid their cables across the trap of it, and then covered up their cables so as to completely choke the drain. In consequence the waste water and other matter from the sink in pursuer's dwelling began to accumulate below the floor of the Eagle Inn, and in April, 1903, pursuer had to repair the floor at a cost of £1 14s. 7d. At a later date, it was again found necessary to repair the floor, and on a search being made, the cause, pursuer alleged, was found to be defenders' unwarranted operation on the drain, which they had choked. Defenders pleaded that, having implemented all their statutory obligations in connection with the operation of the lighting works in Brechin, they were not liable to the pursuer for any loss, injury, or damage which he might have sustained. According to the *Dundee Advertiser*, Sheriff Lee found for the defenders, and awarded expenses.

Llanrwst Electric Co., Ltd.

At Festiniog County Court on Thursday last week, Mr. Cuthbert Smith applied on behalf of Mr. F. P. Farrington, Llandudno, a creditor for £51, for the compulsory winding up of this company. The petition was opposed by the company and by the debenture-holders. The Llanrwst Urban Council, a creditor, was also represented. It was stated that the nominal capital of the company was £5,000, and the ordinary share capital £4,142, and that debentures to the value of £5,000 had been issued. Mr. R. O. Davies said a Receiver (Mr. P. Gregson, Manchester) had been appointed by the debenture-holders, and he had made every effort to sell the place as a going concern, and negotiations were now pending for its sale. The Town Council had refused to take it up. In the opinion of the Receiver, there was not enough to pay the debenture-holders, let alone the creditors. If the petition were granted the petitioner would be no bettter off.

Judge Evans dismissed the petition.

Alleged False Imprisonment.

Last week, at Clerkenwell County Court, a deferred point of law was dealt with by Deputy Judge Edge. Charles Pinkerton, an electrician, of 21, Clerkenwell Road, sued Messrs. Glover & Co., electrical engineers, of Vine Street, Clerkenwell, for £100, as damages for false imprisonment and malicious prosecution.

Whilst carrying out a contract for wiring an exhibition stand at Olympia, plaintiff required a few feet of wire to complete the work. He went to defendants' stall, and it being the usual custom to hire the goods necessary for carrying out such contracts, he obtained it from the boy in charge, saying which stall he was going to use it upon. When the exhibition was over he was given into custody upon a charge of stealing the wire. He was taken before a magistrate, and discharged. For the defence, it was said that no goods were allowed to be taken away from the stall without being booked. The jury awarded plaintiff £15 for malicious prosecution, and £5 for false imprisonment.

Mr. Symmonds raised a point that in order for plaintiff to sustain his case the charge-sheet must be proved. The entering of judgment was deferred for consideration of this point. Later, the Deputy Judge said he agreed with counsel that the charge-sheet was an essential part of the case, but there was ample evidence of the prosecution in its absence.

Mr. Symmonds submitted that the proceedings in the police court must be proved in the present case. It was an important point, because its omission in future cases of the kind might lead any plaintiff to lose an action which he ought to gain.

The Deputy Judge said there was the evidence of plaintiff that he saw Mr. Glover sign the charge-sheet, there was Mr. Glover's admission that he gave plaintiff into custody, and there was the evidence of the detective that plaintiff was given into custody. He thought that was ample evidence in the absence of the charge-sheet. So he should enter judgment for plaintiff with costs.

Punter *v.* L.U.T. Co.

At the Brompton County Court last week application was made for a new trial of a case, in which Charles William Punter, a builder, of Hammersmith, was awarded damages against the London United Tramways, Ltd., in respect of a shock which he is said to have received from an overhead wire falling on him while he was riding on one of the company's cars. The jury added a rider to their verdict, recommending the company to inspect the wires more frequently than they had been doing.

Mr. Craig Henderson, for the company, asked his Honour to grant a new trial on the ground that the verdict was against the weight of evidence and the judicial direction to the jury.

His Honour refused the application, and said he could quite understand a reasonable jury saying that if the company found in the course of running their cars that a wire would break under ordinary working, they should do more to prevent their passengers running any risks.

A stay of execution was granted.

Lund *v.* Lorden Bros.

At the Lord Mayor's Court on February 4th, before Mr. Assistant Judge Jackson, Richard Lund, trading as Lund Bros. & Co., engineers, of Queen Victoria Street, sued Mr. Lorden, trading as Lorden Bros., builders and contractors, to recover £31, the balance of an account for work done and material supplied. According to a report in the *City Press*, plaintiff had supplied the defendant with an oil engine to be used for an electric installation. There was a guarantee of efficiency for the whole of the work for two years. The work was completed in accordance with the estimate, and sums of money were paid on account.

The Plaintiff said that complaints had been made by the defendant in respect of the engine, but those defects were due to the negligence of the person having charge of the engine.

The Defendant said that the engine had never worked satisfactorily. It was part of the arrangement that his (defendant's) man should be thoroughly instructed in his work, but that was not done. By reason of the non-efficiency of the machine he had lost between £70 and £100. He now counter-claimed for £50.

The Assistant Judge gave judgment for the plaintiff on the claim for £28 3s. 2d., and also on the counter-claim.

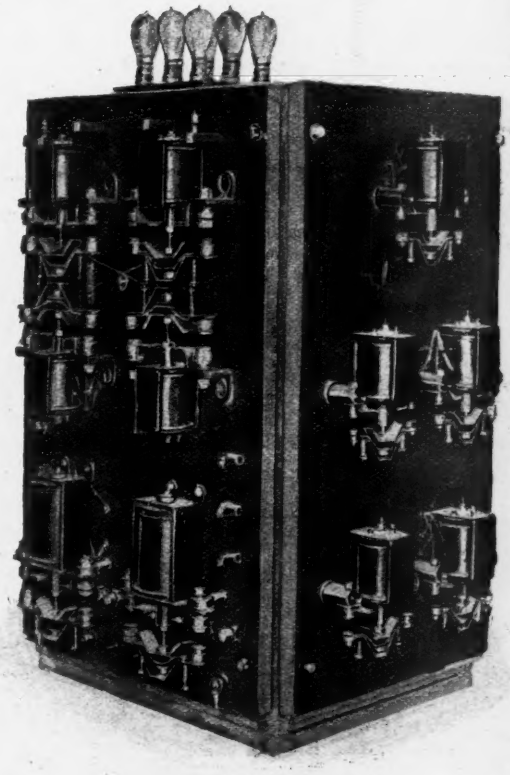
BUSINESS NOTES.

An Electrical Exhibition in Holland.—The Arnhem branch of the Society of Industry (Maatschappij van Nijverheid) is organising an exhibition of electrical appliances for handicraft and domestic use on the occasion of the opening of the Arnhem municipal electricity works. The exhibits will be confined to electric apparatus applied to handicraft and to domestic use in private houses, hotels, hospitals (lighting, hygiene, &c.), but exhibits consisting of other applications of electricity will be admitted so far as space allows. The exhibition will be opened on July 1st in the buildings and grounds of "Musis Sacrum," and will be closed on July 31st, 1907. Applications for space should reach the secretary before March 1st, and should be made on a form to be obtained from him at 52, Amsterdamsche Weg., Arnhem.

American India-Rubber Imports.—The imports of india-rubber into the United States of America have increased by 200 per cent. during the last 10 years, and the total of raw india-rubber alone for the year 1906 was valued at $50,000,000. Over 20 million lb. of used and other india-rubber must be added to this total. Details are at hand for the 10 months ended October 30th, 1906. They give an aggregate amount of 53,500,000 lb. of raw india-rubber, valued at an average of $0·77, or a total of $41,660,000. More than half of these imports, or 26,750,000 lb., are credited to Brazil; the United Kingdom comes next with 8,500,000 lb. Germany sent 3,000,000 lb., and other European countries totalled about 7,000,000 lb. Over 2,000,000 lb. came from the West Indies, Ceylon and the Malay States, while Mexico and Central America furnish 3 and 1 million lb. respectively.

Receiver Appointed.—Morris-Hawkins Electrical Co., Ltd.—On the application of the debenture-holders of this company, the High Court on 5th inst. appointed a receiver and manager.

A Large Lift Controller.—In the notice under this heading in our "New Electrical Devices" section last week (page 213) we find that, through no error on our part, a wrong



Lift Controller.

block was included. The controller there described, as in use at the Hartford Works, Oldham, is now correctly shown in the accompanying illustration.

Bankruptcy Proceedings.—F. E. Williams (F. E. Williams & Co., electrical engineer, 328, Coventry Road, Birmingham.—Order made February 6th at Birmingham.

Motor Price Increase in Germany.—The makers of electric motors in Germany have just decided to make a fresh increase in prices. The advance amounts to 10 per cent., and this makes the total augmentation of 25 per cent. in a period of twelve months. As a cause of the new increase the makers point to the still rising prices for materials, particularly copper and brass.

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Trade Announcements.—Messrs. W. T. Glover and Co., Ltd., of Trafford Park, Manchester, want their friends to take special note of their new telephone number for the works (Local and Trunk). It is 7,200, and there are half-a-dozen lines.

Messrs. Nursey & Marr, mechanical and electrical engineers and contractors, of 53, Victoria Street, Westminster, ask us to state that they are not connected either as agents or in any other capacity with Messrs. Bertram Thomas, of Manchester.

Book Notices.—"Les Fêtes de l'Acétylène," December 15th, 1906. Special illustrated report. Paris: *La Revue des Eclairages.*

"Transactions of the Illuminating Engineering Society." Vol. 1, No. 7, December, 1906. New York: The Society. 50 c.

"Journal of the Franklin Institute." Vol. CLXIII, No. 2, February, 1907. Philadelphia: The Institute. 50 c.

For Sale.—The St. Pancras B.C. is inviting offers for the purchase of a 700-I.H.P. Browett-Lindley triple-expansion three-crank engine, 300 revolutions, 185 lb. working pressure, which has been used for three years. See our advertisement pages for particulars.

Dissolutions and Liquidations.—Motor and Electrical Engineering Co. (Leeds), Ltd.—Creditors are to send particulars of debts, &c., to Mr. R. A. Smithson, Central Bank Chambers, Leeds, the liquidator, by February 28th.

Electric Testing Laboratories, Ltd.—A meeting is to be held at 17, Devonshire Chambers, Bishopsgate Street Without, E.C., on March 15th, to hear an account of the winding up from Mr. W. P. Tomes, liquidator.

Tayler-Smith Electric Co., 28, South Anne Street, Dublin.—Messrs. W. Veitch & H. E. Smith, electric lighting engineers, have dissolved partnership as from August, 1906. Mr. W. Veitch attends to debts.

Dewsbury Electric Manufacturing Co., Ltd.—Creditors are to send particulars of their debts, &c., to Mr. R. S. Dawson, 9, Charles Street, Bradford, the liquidator, by March 28th.

Crossley & Bould, plumbers and electricians, 5, Union Bank Yard, Huddersfield.—Messrs. T. W. Crossley & E. Bould have dissolved partnership as from January 1st.

Catalogues and Lists.—The A.E.G. Manufacturing Co., Ltd., London, W.C.—Leaflet giving a list of prices of Nernst lamps of various types.

The Bryant Trading Syndicate, Ltd., Horsell Road, Highbury, N.—Small pamphlet giving prices of Royal Glow electric incandescent lamps, also a number of illustrations of different patterns.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford.—Illustrated leaflet describing their Whitmore's patent sight-feed, tell-tale lubricator and filter.

Messrs. Cutting Bros., Park Works, Stamford.—Card stating prices of electric motors of from ¼ to 35 H.P.

The Empire Roller Bearings Co., Ltd., 15, Victoria Street, S.W.—New catalogue (24 pages) giving general particulars, together with illustrations, of their roller-bearing axle-boxes for railway and tramway vehicles, also their standard swivel pattern bearings for line shafting. A number of testimonials are printed at the end.

Messrs. Crompton & Co., Ltd., London, E.C.—Illustrated card describing two of their special types of arc lamps for works, colliery and mill lighting, also showing their usual enclosed and open type lamps, and stating prices.

Messrs. Heap & Johnson, 28, Hatton Garden, E.C.—Leaflet stating prices of their "Columbia" dry cells.

Messrs. Parfitt, Webber & Co., Denmark Street, Bristol.—Illustrated circular particularising and pricing their "Colston" accumulators for motor-car ignition purposes and medical coils.

Messrs. Tetley & Co., Manchester.—Leaflet showing Emery's patent automatic electrical time switch.

LIGHTING and POWER NOTES.

Ascot.—The directors of the Ascot District Gas and Electricity Co. are considering, with the advice of Mr. A. H. Dykes, of Westminster, the question of establishing an electricity supply scheme.

Belfast.—As already intimated, the Tramways and Electrical Committee recommended the tender of Messrs. Willans and Robinson, for two 1,000-kw. turbo-dynamos at £14,956, and for condensing plant at £3,191 9s., for the extension of the electricity works. It was shown by the electrical engineer's report that a saving of some £2,000 would be effected in capital expenditure by the adoption of the turbine plant. The City Council referred the contract back to the Committee, as several Councillors opposed the turbo-dynamos. The Committee has, however, re-affirmed its former recommendation.

Bournemouth.—The Electricity Supply Co. has arranged to supply energy to the Corporation tramways at 1¾d. per unit for the first 400,000 units per annum, 1⅝d. for the next 400,000, and 1½d. beyond.

Brandon.—The U.D.C. has entered into an agreement with the North Brancepeth Coal Co. for street lighting at 37s. 6d. per 16-c.p. lamp per annum, 42s. 6d. per 25-c.p. lamp, and 45s. per 32-c.p. lamp.

Bray.—The electrical engineer recently reported to the U.D.C. that considerable extensions to the electricity works were necessary. The Council has decided that it is inexpedient in view of the large indebtedness of the town to further increase that debt, therefore it proposes to offer the undertaking for sale as a going concern.

Brighton.—The T.C. has received from the L.G.B. sanction to a loan of £21,200 for electricity purposes.

Burnley.—There was a disastrous mill fire in Burnley a fortnight ago, and in order that another mill adjoining might continue working, the Electricity Committee has decided to supply energy temporarily at ¾d. per unit. The firm to be supplied is to meet the cost of the mains.

Continental Note.—Russia.—The plant at the Fontanka station of the Société d'Eclairage Electrique de St. Petersburg, is at present being increased to enable energy to be supplied to an additional 100,000 lamps.

Dewsbury.—The T.C. has decided to allow lighting consumers who take a supply on the flat rate of 4d. per unit, rebates as follows:—Above 15,000 units per half-year, 10 per cent.; from 10,000 to 15,000, 7½ per cent.; from 5,000 to 10,000, 5 per cent.; under 5,000, 2½ per cent. For power, heating, cooking, &c., energy will be supplied at 2½d. and 1d. per unit, less 2½ per cent.

Dripsey (County Cork).—The Joint Hospital, Cork, is contemplating the erection of an electrically-lighted sanatorium at Dripsey for consumptives. A four days' inquiry, before Mr. P. C. Cowen, has just terminated, considerable opposition to the scheme having been expressed by local people, and the Cork water supply authority. The amount required to erect the Sanatorium is estimated at £17,650, in which sum £1,686 is included for a kitchen and electric lighting. The proposed site is at Myshell, on the banks of the Dripsey.

East Ham.—The arc lamps used for street lighting, which were displaced by the new type, are to be converted to ordinary single enclosed lamps and offered for sale to private consumers at £2 10s. each.

Eastbourne.—The T.C. has decided to extend the plant at the electricity works at a cost of £9,934.

Eton.—The U.D.C. has sealed an agreement for public lighting with the Windsor Electrical Installation Co.

Gillingham.—The electrical engineer to H.M. dockyard at Chatham has reported that he cannot accept the terms offered by the Corporation, for a supply of energy to the Royal Naval Hospital. The Corporation has been asked to reconsider the matter and say whether it can offer a flat rate of 2½d. per unit for all energy consumed for three years as from May 25th next.

Greenock.—The T.C. has approved of a draft prov. order which seeks, *inter alia*, to obtain further borrowing powers to meet the cost of the new electrical works.

Ivybridge.—On the 6th inst. the electric light was inaugurated in the streets of the town. This is the third system of lighting which has been tried at Ivybridge. In September, 1903, gas illumination was superseded by oil, and the latter not being considered satisfactory, at the end of November last the U.D.C. decided upon another change. Energy is supplied from the power plant of the Lee flour mills, the prime mover being a water turbine situated on the River Erme. At present about ¾ mile of mains have been laid down, and the main street will be lit by 12 tantalum lamps of about 50 c.p. (two bulbs per lamp). We understand that Messrs. W. G. Heath & Co., of Plymouth, have entered into a contract to light the streets by electricity for 10 years.

Leeds.—The City Council has a project in hand to extend the mains in the city as follows:—Cost of the Moortown section, £6,550; and Lydgett Park extension, £9,300.

Little Hulton.—The U.D.C. has signed an agreement with the Lancashire Electric Power Co. for a supply of electricity to the district. Mains have already been laid down.

London.—L.C.C. Power Supply Bill.—The Legal and General Committee of the West Ham Corporation has issued a report covering 12 closely-printed pages on the above Bill. It has announced its intention to present a petition against the Bill. The borough electrical engineer has also reported upon the matter.

The Battersea B.C. is to petition against the Bill.

The Law and Parliamentary Committee of Holborn B.C., in reporting upon the Bill, said that any opposition to the Bill on the part of the Holborn Council could substantially only be based on financial grounds, and would accordingly carry little weight. The Committee thought that effective opposition is far more likely to come from authorities more intimately concerned by reason of owning electrical undertakings or otherwise. It had accordingly decided not to make any recommendation to the Council in regard to the Bill.

The Finance, Electric Lighting, and Law and Parliamentary Committees of Hackney Borough Council have issued a joint report to the effect that they had considered a reference as to whether the interests of the borough were adequately protected in view of the promotion of the L.C.C.'s Electricity Supply Bill, and Mr. Robert Hammond's connection therewith. The Committees, after an interview with Mr. Hammond on the matter, ascertained that he had been retained by the L.C.C. as expert adviser in connection with its Electric Supply Bill, and that he had advised the L.C.C. upon the part of the scheme as regards the undertakings scheduled in the Bill, and would necessarily give evidence before Parliament in support thereof. The B.C. considers the Bill prejudicial to its interests, and has lodged a petition against it. Mr. Hammond admitted that he would be unable to give evidence on the Council's behalf in opposition to the L.C.C. Bill, or assist, by consultation or otherwise, in any way. Having regard to these facts, the Committees were of opinion that it was impossible for Mr. Hammond to act as the Council's consulting engineer, and that it would be inadvisable for the Council further to make use of his services in connection with the undertaking, and they recommended that Mr. Hammond be informed that his services to the Borough Council would no longer be required.

L.C.C.—The Parliamentary Committee, in a report presented at Tuesday's meeting of the L.C.C., referred to the application made by the Bermondsey B.C. to the B. of T. for a prov. order to extend its area of supply. The area proposed to be added is also supplied by the County of London Co. and the London Electric Supply Corporation. The B.C. intended that its orders of 1899 and 1902, and its new order should be read and construed together as one order. The Committee had prepared certain slight amendments in the order with the object of bringing it into conformity with the standard form adopted in such orders in the past, and on the recommendation of the Committee, the Council resolved to ask the B. of T. to make the desired amendments.

On Tuesday the L.C.C. adopted resolutions deciding to oppose the following Bills, to seal and present the necessary petitions, and to charge the costs and expenses to the county fund:—The Administrative County of London and District Electric Power Bill, the London Electric Supply Bill, the North Metropolitan Electric Power Supply Bill, and the Watford and Edgware Railway Bill. The question of also opposing the Electric Supply Corporation, and the London and District Electric Power Bills was not moved—that is, the projected opposition has been withdrawn.

Stepney.—The E.L. Committee reported that upon several occasions the Council had formulated special charges for the supply of energy to the various classes of consumers but had not yet formulated a specific charge for energy supplied in bulk for all purposes. In this connection the Committee had been requested by the London, Tilbury and Southend Railway Co. and by the London and India Docks Co. to formulate such a charge. The question involved is undoubtedly an important one from the point of view of the development of an undertaking. There are special considerations in connection with such a supply, one being that such companies taking a bulk supply for both lighting and power purposes, their demand would occur during the day and night, and thereby make for a better load factor. The Committee has decided (subject to the usual sanction): "That the rate of charge for energy supplied in bulk for power, lighting and all other purposes to railways, docks, and canals, and for bulk supplied at 480 volts to any large private consumer by means of motor converters, for a mixed supply for all purposes, be: 5d. per unit for the first 30 hours' use of the maximum demand during each of the six months ending September inclusive, and ¾d. per unit for all further consumption in each month. Provided that any consumer requiring a supply at these rates shall enter into an agreement to take a supply for three years, and shall agree to pay a minimum annual bill during that time of £1,000. In calculating the total amount of such account for the purpose of arriving at the minimum above mentioned, the accounts for different premises supplied by separate service cables may be added together provided that the average annual amount of each account so added together shall not be less than £500. That this rate shall, so far as it is applicable to the London, Tilbury and Southend Railway Co., come into force as from October 1st, 1906."

Battersea.—The electrical engineer has submitted a scheme for completing the lighting of the roads on the Park Town Estate. The scheme provides for the conversion of 68 disused gas lamp columns, and the fixing of brackets to same, the necessary tantalum lamps and ducts in certain streets, but does not provide for distributing mains for private supply. The ducts, however, will only be laid in the event of the South-Eastern and Chatham Railway Co. agreeing to take a supply of electrical energy for their works in this part of the district. The estimated cost of laying the ducts is £230, and for carrying out the whole of the scheme of public lighting, including ducts, £2,040. The additional cost of providing distributing mains for private lighting is estimated at £320.

Poplar.—At a meeting of the B.C. on the 7th inst., a motion was put by Alderman P. A. White that the clerk invite the Commercial Gas Co. to state fully the conditions and terms upon which it would, if required, undertake to illuminate by gas, with an efficiency equalling, and where reasonably possible or necessary, exceeding that obtaining in the roads now lighted by electricity, the offers to show the cost of conversion. That upon the receipt of the same, the Finance Committee should advise the Council as to the financial results which would accrue from the use of gas as the sole illuminant for the roads of the borough. It was emphasised that nothing was proposed except to ask for information. It was mentioned that in the near future the Council would be asked to consider a proposal for considerable expenditure in connection with the extension of the electricity undertaking. On a division, the motion was negatived by 25 votes to 16.

Mansfield Woodhouse.—The P.C. has consented to the application of Mansfield T.C. for a prov. order for electric lighting.

North Shields.—A L.G.B. inquiry was held on February 6th into the application of the T.C. for a loan of £9,500 for electricity purposes. As further particulars were required the inspector adjourned the inquiry.

Ossett.—The T.C. has, by 8 votes to 7, rescinded the resolution passed on January 14th to the effect that the Council was not in favour of any E.L. scheme for which the Council has to provide the capital.

Rochester.—The Kent Electric Power Co.'s new station at Frindsbury is now supplying the whole of the company's system. The contract with the Gillingham Corporation for a bulk supply has lapsed.

South Bank-in-Normanby.—Subject to the approval of the B. of T. the U.D.C. has decided to transfer the E.L. order to the Cleveland and Durham County Electric Power Co., who will pay the Council £186.

Swansea.—The T.C. propose to wire for electric light 97 houses to be built for working classes at Plasmarl.

Textile Mills.—Electric driving has been adopted for the machinery at the Droylsden Mills, Fairfield, near Manchester, belonging to Messrs. Ashworth, Hadwen & Co. In this mill both spinning and weaving are carried on, and there are 89,000 spindles and 900 looms. The old beam engine which drove the machinery for 70 years has been replaced by a turbo-generator. There was a gathering at the mill last week of gentlemen interested in this new departure, and the firm entertained them to luncheon. Mr. Gorham (of Messrs. Drake & Gorham, by whom the installation had been made) spoke of the superiority of electricity for textile mills. These were, he said, steadiness of drive, faster speed, fewer breakages, with greater economy and adaptability. Tests showed that from 4 to 6 per cent. increase in speed was attained, with consequent greater production. There was also economy and less waste of power, and smaller engine space was required.

West Ham.—The Thames Iron Works Co. has intimated to the borough electrical engineer that it will shortly most likely be requiring a large alternating-current supply in addition to the present direct-current supply.

Westhoughton.—The U.D.C. has sealed an agreement with the Lancashire Electric Power Co. for the supply of energy in bulk.

TRAMWAY and RAILWAY NOTES.

Bournemouth.—In a report upon the Corporation accounts for the year ended March last, the L.G.B. auditor has stated, in regard to the tramways, that he is of opinion that it would not be prudent to reduce the reserve fund by lowering fares, or otherwise. This point has not been overlooked by the Corporation, but the auditor draws attention to the fact that the success of a tramway at a seaside resort is dependent to a considerable extent upon visitors.

Canada.—Toronto.—The Ontario Railway Board has ordered the Toronto Street Railway Co. to continue to operate its lines on the new routes adopted by the company, and has asked the city authorities to refrain from interference until the whole question of routes has been thoroughly discussed and the legal position clearly defined. The Toronto Railway Co. is at present receiving energy to the extent of 4,000 H.P. from Niagara.

Continental Notes.—Italy.—The *Standard* last week stated that the Italian Government has definitely determined upon the electrification of certain lines of the State railways. The project includes the Lecco-Milan section, which is to connect the present electric railway on the left bank of the Lake of Como with Milan. The line branching from this electric railway to Bergamo is also to be electrically equipped, together with the line from Milan to the Simplon Tunnel, the connecting line to the Gothard Railway, Milan-Luino on Lake Maggiore, the Giovi Tunnel on the Milan-Genoa line, and the tunnel under the town of Genoa. In addition to these, the electrification scheme comprises, in central Italy, the section over the Apennines between Florence and Bologna, and in southern Italy, the section Naples-Salerno, together with other branches. Plans for the electrification of the line from Turin to Torrepellice have been submitted to the Ministry of Public Works. The necessary funds having been obtained, the construction of a new electric tramway between Varese and Bizzozzero will shortly be commenced.

France.—An electric cable railway is being constructed from Bourdeau, on Lake Bourget (Savoy), up the Mont-du-Chat. The line will be about ½ mile long, and rises in that distance a height of just over 1,000 ft.

East Ham.—The points at issue in connection with the Barking Light Railway lease were discussed recently between representatives of the Barking U.D.C. and the East Ham Corporation. It was agreed that a lease, of the Barking lines be accepted by East Ham for five years from November, 1905, and that the question of inter-running be deferred. East Ham will pay an annual rental of £642, plus an ageed sum per car-mile run. Energy will be supplied by Barking U.D.C.

Halifax.—On Friday night last, a car at New Bank got out of control under precisely similar circumstances to the one which was involved in the fatal disaster of June 30th last. Fortunately, however, on this occasion the car took the points at North Bridge safely, and kept to the track. Some ten passengers were in the car; six jumped off, and five escaped with slight injury, the other sustaining injuries to the head. Our local correspondent says the slipper brakes were much worn, the rails were greasy and the frost had affected the sand apparatus and rendered its action imperfect.

Lancashire and Yorkshire Railway.—At the half-yearly meeting of the Lancashire and Yorkshire Railway Co., the chairman (Sir Geo. Armytage) stated that a considerable amount of the traffic lost by tramway competition was returning, especially in the districts where they had an electric service of trains, and also in those districts where they had instituted rail motors. The traffic on the newly-electrified service between Liverpool and Aintree had already developed in a gratifying manner.

London.—Several accidents occurred on the tramways in the suburbs during last Friday and Saturday. On the former day, a tramcar and motor-omnibus collided at Camden Town, resulting in considerable damage to the vehicles and shock to passengers. An L.C.C. car came into collision with a traction engine at Balham, which delayed the traffic for some considerable time. Two collisions took place on the County Council's Embankment section; on Friday a tramcar and a motor-cab took part in one, the latter becoming jammed between the tram and a tree, and in the other instance two tramcars were damaged through colliding with each other. On the Leyton U.D.C. tramway a dray collided with a car, with the result that the horses bolted and knocked down three or four people, and did damage to other property. A more serious accident happened on Saturday night on the L.U.T. system at the Uxbridge Road and Askew Road junction. A fog prevailed at the time. As a car was negotiating the junction bound east, a car from Shepherd's Bush ran into it broadside. Several passengers received injury, and eight were treated at an adjacent surgery. The cars were considerably damaged, and it was over an hour before they could be removed.

Macclesfield.—The T.C. has declined to consent to the construction of tramways in the town, until the extension to Hazel Grove, near Stockport, is completed.

Newcastle-on-Tyne.—At a meeting of the City Council on the 6th inst., the Parliamentary Bill, which proposed, amongst other things, to effect certain extensions of the tramway system, was further considered, and ultimately it was decided to withdraw the Bill. The latter had been approved by the Council, and, with the exception of one clause relating to some street improvements, had been passed by a public meeting of the ratepayers. The Council, however, declined to have a poll of the ratepayers, as was necessary, and thought the tramway matters could lie over for 12 months, and consequently withdrew the Bill.

North-Eastern Railway.—On the 8th inst., at the half-yearly meeting of the North-Eastern Railway shareholders at York, the Rt. Hon. John Lloyd Wharton, the chairman, in moving the report, said in respect to the electrified lines he had had some figures taken out. During the past half-year there had been carried on the Newcastle and Tynemouth branches, between June and December, 1906, 4,195,339 passengers; and in the corresponding half of the previous year the number was 3,548,206 passengers. They took in money for tickets in the last half-year £54,389, and in the corresponding half of the previous year £47,423. Another satisfactory circumstance with regard to the working of these lines was that there had been a reduction in the working expenses, though not to a very large extent—£477. As the system was new, it was impossible to say at what figure the depreciation should be put; but in a year or two, probably they would be able to say what it should be.

Torquay.—The clerk recently informed the T.C. that no further letters had been received from the Dolter Co. as to the account for the half-year's minimum charge for electrical energy to October 27th, and he was instructed to write requesting payment before the next meeting. It was suggested that the Dolter Co. was playing with the Council.

Walsall.—The balance-sheet of the Corporation Tramways, issued last week, shows a net profit for the year ended December 31st of £4,389, against £3,894 in 1906. The traffic revenue shows an increase of £1,013 over that of the previous year. The average revenue per car-mile was 10·36d., against 9·36d. The total revenue per car-mile was 10·57d., against 10·05d. There was an increase of expenditure of £903 over 1905. The Tramways Committee has recommended the Council to continue its policy of the two previous years by transferring the whole of the profit to the reserve fund.

TELEGRAPH and TELEPHONE NOTES.

The Hand-Set Doomed.—It is stated that the Post Office and the National Telephone Co. have decided to make no further installations of the combined receiver and transmitter, and to weed it gradually out of places in which it has already been installed. Better results are said to be obtained with the fixed mouthpiece, under the central battery system now in general use.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	..
Paramaribo-Cayenne	Nov. 27, 1906	..
Cayenne-Pinheiro	Aug. 13, 1902	..
St. Lucia-Martinique	May 7, 1902	..
Dominica-Martinique	May 7, 1902	..
Curacao-Coro / Curacao-La Guayra / Curacao-Maracaibo } Closed..	Jan. 12, 1906	..
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904	..
Garachico-Santa Cruz	July 12, 1906	..
Las Palmas-Arecife	Aug. 18, 1906	..
Guantanamo-Mole St. Nicholas	Nov. 22, 1906	..
Mole St. Nicholas-Cap Haytien	Nov. 22, 1906	..
Fao-Bushire	Dec. 4, 1906	..
Martinique-Paramaribo	Dec. 17, 1906	..
New Brunswick-Prince Edward Island	Jan. 9, 1907	..
Odessa-Kirios	Feb. 9, 1907	..
Communication with Punta Arenas (Chili), *via* Galveston	Feb. 6, 1907	..
Tenedos-Lemnos	Feb. 7, 1907	..
Landlines.		
Puerto-Barrios	Aug. 28, 1902	..
Odessa-Keitch	Feb. 6, 1907	Feb. 6
Bagdad-Bassorah	Feb. 11, 1907	Feb. 11

Wireless Telegraphy.—The protected cruiser *Vineta* is about to undertake a fresh expedition from Kiel, which is expected to lie in the direction of the west of the Mediterranean, for the purpose of experiments in wireless telegraphy for the German Navy. It is stated that the apparatus with which the vessel is equipped is superior to that of any other warship, and the hope is expressed that it will thereby be possible to succeed in transmitting information over a distance that has never previously been achieved. In 1906 the cruiser *München* worked in conjunction with the Norddeich station, and received signals up to a distance of 744 miles, whilst the *Vineta*, which at that time was to have proceeded as far as Tromso, suffered a loss in consequence of the breaking of the standard carrying the antenna. This cruiser has now been provided with a mast whose elasticity will enable it to offer sufficient resistance to storms, and it is intended to make experiments between the vessel and the wireless station at Nauen, near Berlin. It is expected that the improved apparatus fitted on the cruiser will enable communication to be established for a distance of 1,860 miles, this comparing with a range of 1,520 miles over which messages have already passed between German merchant steamers and stations on the coast.

The second-class cruiser *Furious*, in the Tyne, last week was in communication with Portsmouth.

CONTRACTORS' COLUMN.

Openings for New Business.

BACUP (New Line).	New cotton spinning mill for Ross Spinning Co. (£60,000).
BAGGERIDGE WOOD (Dudley).	New colliery. John Hughes, mining engineer, Priory, Dudley.
BARNSTAPLE (The Strand).	Gentlemen's Club. Messrs. Bryant & Sons, Bear Street Barnstaple.
BARRY.	New parish church (£7,000). Bruce Vaughan, architect, Cardiff.
BELFAST.	Works extensions for Ritchie, Hart & Co., contractors. J. & R. Thompson, Ltd.
BIRKDALE (Lancs.).	New sewage works at Ainsdale, including electrical plant. The scheme has just been submitted to L.G.B. Contractors, the Septic Tank Co., London. Mr. J. F. Keeley, clerk to Urban District Council.
BIRMINGHAM (Bordesley Green).	Police station (£8,906). T. Elving, builder, Naden Road, Soho Hill, Birmingham.
BLAENGARW.	New public bath, gymnasium, &c., at the Workmen's Hall and Institute. J. Morris Williams, architect, Blackmill, near Bridgend.
BOLTON.	Messrs. T. M. Hesketh & Co. are enlarging their No. 3 mill, Bolton; and Messrs. W. & C. Ainsworth are also carrying out extensions at their mills at Great Lever, Bolton.
BRADFORD.	New printing works and warehouse in Chapel Street. B. D. Fairbank & Son, architects, Craven Bank Chambers, Bradford.
BRADFORD	Town Hall extensions. F. E. P. Edwards, city architect, Whitaker Buildings, Victoria Square.
BRISTOL.	New Baptist College (£18,000), Tyndall's Park. Oatley and Lawrence, Edinboro' Chambers, Baldwin Street, Bristol, architects.
BRISTOL	New granary at Avonmouth Dock (£69,609). In other Bristol dock granaries electric power and lighting are used. W. W. Squire, dock engineer, Cumberland Road, Bristol.

BUCKHAVEN (Fifeshire).	School at Denbeath (seat 1,000). G. C. Campbell, architect, Buckhaven.
CRESSWELL (near Worksop, Notts.).	New post office, bank, three shops and houses. Architect, F. Hopkinson, Worksop.
DARLINGTON.	Motor garage showrooms and workshops, Grange Road, covering an acre of ground, for Cleveland Car Co., a branch of the Cleveland Bridge and Engineering Co., Ltd. Architect, G. Walesby Davis, Prebend Row, Darlington.
DARLINGTON.	Fry, J'Anson & Co., Ltd., Rise Carr Rolling Mills, installation for lighting and power. Details and source of supply not decided upon yet. May generate power instead of taking from Corporation.
DARLINGTON.	Villa residences for medical man, Grange Road. G. Walesby Davis, architect.
DERBY.	Extensions of County Buildings. G. C. Copestick, architect, St. Mary's Gate, Derby.
DUNDEE.	College, Physics Laboratory (cost £12,500). Sir Rowland Anderson, architect, to submit plans.
DUNDEE.	New Technical Institute (£27,500). Mechanical and electrical engineering to be accommodated. Robert Gibson, architect, 2, India Buildings, Dundee.
DUNFERMLINE (Fife).	Branch library and reading room at Baldridgebarn for Carnegie Dunfermline Trustees (£5,000). H. & D. Barclay, architects, Glasgow.
DURHAM.	New school at Shildon, also alterations to school and cookery centre for County Council Education Authority. W. Rushworth, architect, Shire Hall, Durham.
FALMOUTH.	New school at Clare Terrace. Education authority.
GLAMORGAN.	New School at Rhos, near Pontardawe for the County Council. T. Mansell Franklin, clerk to Council, Westgate Street, Cardiff.
GLASGOW.	Fruit Market (large extension). A. B. Macdonald, city engineer, City Chambers, Glasgow.
GLASGOW.	Cattle Market (large extension). A. B. Macdonald, city engineer, City Chambers, Glasgow.
GLASGOW.	New Maternity Hospital. A. Forbes, secretary, 146, Buchanan Street.
GLOSSOP (Partington).	Convalescent and nurses' home for Corporation. Bulman & Vinycomb, architects, 67-69, Chancery Lane, W.C.
GREAT WYRLEY.	Landywood new Council School for Staffordshire Education Committee. Graham Balfour, Director of Education, County Education Offices, Stafford.
HASTINGS.	Central Fire Station.
HEATH TOWN (near Wolverhampton).	New Council School, Woden Road. Builder, J. Lindsey-Jones, Darlington Street, Wolverhampton. Architect, J. Hutchings, County Education Offices, Stafford.
HIGH WINCOBANK (Sheffield).	Church, school, and 35 houses on Corporation Model Estate.
KINGSTOWN (Ireland).	New Baths, Queen's Road. Kaye-Parry & Ross, architects, Dawson Street, Dublin.
LEEDS.	Warehouse, Harewood Street. Apply, Mosleys, 6, Wormald Row, Leeds.
LEEDS.	New Department of Mining at the University.
LINCOLNSHIRE (Scartho).	New municipal sanatorium for Grimsby Town Council, site purchased. Borough surveyor, Grimsby.
LONDON.	New School for Children, Osborn Place, Whitechapel, for L.C.C. Messrs. Grove are contractors.
LONDON.	Yeomanry Riding School and other buildings in Elverton Street, Horseferry Road. Contractors, G. Longden and Son.
LONDON (Wandsworth).	Public Elementary School. G. L. Gomme, clerk to L.C.C.
LONDON (Harrow Road).	Hippodrome. B. Crewe, 3 and 4, Savoy Mansions, Savoy Hill, W.C., architect.
LONDON (Battersea Park Rd.).	Wing to Convent of Notre Dame. W. J. Renshaw, 287, Upper Richmond Road, Putney, S.W., builder.
LONDON (Uxbridge Road).	Rebuilding (£25,000) for Eastman & Son, dyers and cleaners. Work just started. Previous buildings lighted throughout with electricity. Architect, G. Percy Pratt, High Street, Acton.
LONDON (Kensington).	Blocks of residential flats, Gloucester Road. Paul Hoffman, 150-3, Palmerston House, Bishopsgate Street, E.C., architect.
LONDON (Borough, S.E.)	Additions, costing £11,500, to Borough Polytechnic.
LONDON (St. John's Wood).	Church and schools. Architects, Smee & Houchin, 85, Fleet Street.
LONDON (South Kensington).	Buildings. W. G. Hunt, architect, 17A, Vicarage Gate, Kensington, W.
LONDON (St. Pancras East).	Two blocks of flats. E. E. Moore, builder, 65, West Hill Road, Wandsworth.
MATTERDALE.	Elementary School. J. Forster, 13, Earl Street, Carlisle, architect.
MERTHYR.	Conversion of ward into operating theatre at Merthyr General Hospital. E. M. B. Vaughan, architect. 21, Dumfries Place, Cardiff.
MICHAELSTON-Y-VEDW.	Alterations and additions to "Lockwood," Marshfield. W. H. D. Caple, 2, Church Street, Cardiff, architect.
NEWCASTLE-ON-TYNE.	Station buildings and platform. Wm. Bell, architect, Central Station, Newcastle-on-Tyne.
NEWCASTLE-ON-TYNE.	Large block of offices, Cloth Market and Moseley Street. S. D. Robins, 129, Percy Street, Newcastle.
OLDHAM (Bottom o' the Moor).	New theatre. Architect, Thomas Taylor, 29, Queen Street, Oldham.
POOLE.	New Police Station; County Surveyor.
PORTOBELLO (Edinburgh).	New school at Towerbank (£10,700). Edinburgh School Board's architect.
PRESTON.	Domestic science centres for the Corporation. Borough surveyor, Town Hall.
RADCLIFFE-ON-TRENT (near Nottingham).	New schools for Notts. County Council Education Committee. C. J. Bristowe, Shire Hall, Nottingham, Director of Education.
ROCHDALE.	Technical school extensions. Wm. H. Hickson (town clerk).
SHIPLEY (Yorks.).	St. Peter's Church. T. H. & F. Healey, Tyrrel Street, Bradford.
SILVERTOWN, E.	Soap factory for Co-operative Wholesale Society, Silvertown.
SOUTHPORT.	Rebuilding of North Meols Church (contemplated). Rev. R. B. Blakeney, the Rectory, Southport.
SOUTHPORT.	New Cottage Hospital.
STREATHAM.	73 houses. C. M. Quilter, architect, 1 and 2, Adam Street, Strand.
SWINDON.	42 houses. A. J. Coltourne, builder, Swindon.
WAKEFIELD.	New Chronic Block for the West Riding Asylum Committee. J. Vickers-Edwards, county architect' County Hall.
WALLSEND-ON-TYNE.	New Theatre, Portugal Place (on site of one destroyed by fire). White & Stephenson, Newcastle-on-Tyne, architects.
WARRINGTON.	Bolton County School. J. M. Murray, secretary and director, Education Office, Sankey St., Warrington.
WOLVERHAMPTON.	New church, St. Chads. F. T. Beck, architect, Darlington-street, Wolverhampton.
WOOLWICH.	Additions, costing £14,017, to Avery Hill Training College for L.C.C.
WREXHAM.	Royal Oak Inn, rebuilding. F. A. Bevan, Queen Street, Wrexham. Owners, Peter Walker & Co., Burton-on-Trent.

CONTRACTS OPEN and CLOSED.

OPEN.

Battersea.—March 5th. Various materials for the electricity department. See "Official Notices" to-day.

Bedford.—Electric motor and pump at the Well in Bedford Park, for the Corporation Public Works Committee. N. Greenshields, Borough Surveyor, Town Hall.

Belgium.—March 30th. The municipal authorities of Liége invite tenders for a central station. For further particulars see our issue of January 25th.

Berlin.—February 20th. The Prussian Government Railways require tenders for insulators, bronze wire, galvanised wire, copper wire, &c. Particulars may be obtained by enclosing 6d. to the Director Eisenbahn Telegraph Amt, Berlin.

Blackburn.—February 18th. Stores for the Electricity and Tramways Committee for one year. See "Official Notices" February 1st.

Bremen.—February 18th. Equipment of water turbine works for operating five 400-kw. (each) polyphase generators. For further particulars see our issue of 1st inst.

Copenhagen.—March 18th. Two steam turbine alternators (three-phase), 2,500 kw. each, for the Corporation. See "Official Notices" January 25th.

Dublin.—February 28th. Steam turbine alternating current set (1,500 or 1,000 kw.) for Pigeon House generating station. See "Official Notices" to-day.

Edinburgh.—February 18th. Exhaust steam turbines and d.c. generators for the electricity station in M'Donald Road. See "Official Notices" January 25th.

Fulham.—February 27th. General and electrical stores for the B.C. See "Official Notices" to-day.

Gravesend.—March 2nd. Coal, engine room stores, carbons, meters and indicators, &c., for the Corporation. See "Official Notices" to-day.

Handsworth.—March 7th. Switchboard extension and equaliser booster for the U.D.C. See "Official Notices" to-day.

Hornsey.—February 20th. Meters, cable, troughing, &c., for the B.C. See "Official Notices" February 8th.

Iceland.—March 31st. The Reykjavik Town Council is open to give a concession for the supply of electrical energy and gas. See "Official Notices" December 7th.

Ilford.—February 26th. Feeder booster and switchboard for the U.D.C. See "Official Notices" February 8th.

Ilford.—February 26th. Stores for the U.D.C. electricity and tramway departments. See "Official Notices" to-day.

Islington.—February 21st. Transformers, cable, jointing material, and boxes for the Council. See "Official Notices" to-day.

L.C.C.—February 19th. Tenders are required by the Council for 300 pairs of maximum-traction swing-bolster trucks. See "Official Notices" February 8th.

Linz (Austria).—February 25th. The Administration of the Austrian Government Railways at Linz requires tenders for an electric light and power installation in connection with the electrification of their lines.

Marylebone.—March 13th. Stores for the electricity department. See "Official Notices" to-day.

Northampton.—The Northampton Electric Light and Power Co. requires tenders for coal for the year 1907-8. See "Official Notices" to-day.

Paris.—February 21st. Tenders are required by the Etablissement Central du Matériel de la Télégraphie Militaire, 51 bis, Boulevard de Latour-Manboug, Paris, as follows:—(1) Elements and accessories for batteries; (2) cases for Morse and other apparatus, batteries, &c.; (3) line material; (4) wood; (5) office requisites; (6) postal telegraph apparatus and reserve pieces; (7) official telegraph apparatus, &c.; (8) telephone instruments and accessories.

Perth (Western Australia).—March 25th. Lead-covered paper-insulated telephone cable. See our issue of 1st inst.

Roumania.—February 21st. Tenders are invited by the municipality of Focshani for the concession for the electric lighting of the town.

Roumania.—February 23rd. The municipal authorities of Pitesci are inviting tenders for the concession for the electric lighting of the town.

Salford.—February 16th. Supplies for 12 months, including cables, meters, arc-lamp carbons, lamps, switches, motors, motor-starters, instruments, &c. See "Official Notices" Feb. 1st.

Salford.—February 16th. The Electricity Committee invites tenders for the purchase of second-hand electric motors, varying in size from ½ to 25 B.H.P., D.C. and three-phase. Particulars from the Borough Electrical Engineer.

Sheffield.—March 4th. Water storage reservoir, valves, screens, &c., for the City Council. See "Official Notices" to-day.

Sheffield.—March 25th. Machines for regulating the power factor of an A.C. supply system for the electric supply department. See "Official Notices" to-day.

South Australia.—March 6th. The Postmaster-General requires tenders for telephone and telegraph material. For particulars see our issue of January 18th.

Spain.—February 18th. Tenders are required by the Vigo municipality for the construction and working of an electric tramway in the town. Particulars can be obtained from El Secretario del Ayuntamiento de Vigo.

Spain.—February 25th. Tenders are being invited by the municipal authorities of Meliana (province of Valencia) for the concession for the electric lighting of the town during a period of four years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Meliana (Valencia).

Spain.—February 25th. The municipal authorities of Olivenza (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of eight years. Tenders are to be sent to El Secretario del Ayuntamiento de Olivenza, whence particulars may be obtained.

Spain.—March 31st. The Harbour Works authorities at Huelva are inviting tenders for the establishment of a central station for the supply of the necessary electrical energy required for lighting and power purposes at the harbour.

Stockport.—February 25th. Five double-deck top-covered cars, single-truck type, with electrical equipments, for the Corporation. Particulars from J. Atkinson, borough surveyor.

Stockton-on-Tees.—February 20th. Stores for the year for the Corporation. See "Official Notices" February 8th.

Sunderland.—March 1st. (*a*) Buildings and shaft; (*b*) three-phase turbo-generator, condensing plant, cooling towers; (*c*) water-tube boilers, economisers, &c., for the Corporation. See "Official Notices" February 8th.

Sydney (N.S.W.).—March 6th. Tenders for the supply of 7½ tons of hard-drawn copper wire, 200 lb. per mile. For further details see our issue of January 25th.

War Office.—February 25th. The Secretary for War invites tenders for the purchase of Lancashire boilers and condensing engine at Waltham Abbey.

Weymouth and Melcombe Regis.—February 21st. Stores (brushes, packing, oil, tools, &c.) for the borough electricity supply department. H. A. Huxtable, town clerk, Municipal Buildings.

CLOSED.

Belfast.—At the meeting of the Tramways and Electrical Committee on 11th inst. Mr. M'Cowen, electrical engineer, expressed the opinion that the tender of Messrs. Willans & Robinson, Ltd., for the turbo-dynamos would be the most advantageous to the Corporation. Mr. Robinson, a member of the firm, was present, and said that his firm could finish the contract in the time specified. The Committee unanimously recommended the Council to accept the tender. The tender is £14,956 for two 1,000-KW. turbo-dynamos, and condensing plant, at £3,191 9s.

Bridlington.—The T.C. has placed an order with the Cruse Controllable Superheater Co., Ltd., for two patent controllable superheaters, at a price of £425; and with Messrs. Royle's, Ltd., for water distilling plant, at £20.

Bray.—The tender of Messrs. Johnson & Phillips for a high-tension switchboard and instruments, at £429, has been accepted. Thirteen tenders were received.

Brighton.—The T.C. on February 7th accepted the tender of Messrs. Geipel & Lange for the supply of arc lamp carbons, at £263.

Bury (Lancs.).—The T.C. has accepted the tender of Messrs. Jas. Byrom, Ltd., of Woolfold, for the extension of the central tramway depôt.

Derby.—At a special meeting of the T.C. on February 6th, the following tenders were accepted in connection with the extension of the Corporation electric light works:—

Boilers, &c., Babcock & Wilcox, £7,480.
Economisers, Messrs. E. Green & Son, Ltd., £830 10s.
Coal bunkers, &c., The Chain Belt Engineering Co., £3,772.
Induced draught plant, Messrs. Musgrave & Co., £1,650.

These amounts were included in the sum of £47,000 granted by the Council on November 9th, but objection was taken to them on the ground that the necessary sanction to borrow the money had not been obtained. Ald. Hart (chairman of the Finance Committee) said that Committee would not undertake the responsibility of borrowing the money until permission to do so had been received. Ald. Butterworth, J.P. (chairman of the Electric Light Committee) said he was not quite certain whether, strictly speaking, Mr. Hart was entitled to speak upon the matter. If the resolution was not passed and the contracts entered into, the work of the E.L. Committee would be most seriously incommoded. It was absolutely necessary for the Committee to have further machinery at work in the early part of October in order to meet its requirements in regard to the supply of electricity, and if it did not, another firm in the town, in which Ald. Hart and others who had spoken were large stockholders, would be benefited to a great extent. Under the circumstances, he challenged the amendment of Ald. Hart, and characterised his action as simply a matter of harrassing the work and business of the Electric Light Committee. Ald. Hart said he should not surrender his right to criticise the lavish and wasteful expenditure of the Electric Light Committee. Whenever he had ventured on the Committee's action, Ald. Butterworth never failed to dangle before the Council the bogey of the Gas Co. He was connected with the Gas Co., and if he was acting illegally any common informer had his remedy. As long as he was a member of the Council he was not going to abandon his rights, as a representative of the ratepayers, to object to any course which he thought irregular.

Derby.—At the last T.C. meeting the tender of Messrs. Blackwell & Co. for the construction of the electric tramways on the Ashbourne and Uttoxeter Road routes, at £29,331, was accepted. Ald. Spriggs said there were four tenders under £30,000, five under £31,000 and three under £33,000.

Gillingham (Kent).—The T.C. has accepted the tender of the Medway Motor and Electrical Engineering Co. for assisted wiring, at 13s. per point in conduit, and 11s. per point in wood casing.

Glasgow.—Electric wiring for new Corporation property. James Hutcheson, 199, Bath Street. The Corporation Tramways Committee has accepted the following offers:—

Overhead insulating material.—Estler Bros.
Machine combs.—Alex. Mathieson & Sons, Ltd.
Coir matting for Pinkston power station.—Asylum for the Blind.
Relays, P.O. pattern.—May-Oatway Fire Appliances, Ltd.
Cast-iron manhole frames and covers.—R. Howie & Co.
Aluminium ribbon leaf.—Coe Ribbon Gold Leaf Manufacturing Co.
Emery buffs for grinders.—L. Sterne & Co.
Oil tank and die stocks and dies.—J. T. Donald and Co.
Circuit-breaker handles.—Consolidated Supply Co.
Leather gloves for tower wagon men.—A. Baily & Co.
Globes for arc lamps.—Brockie-Pell Arc Lamp, Ltd.
Lead-sheathed cable.—National Conduit and Cable Co.
Reinsulating cable.—British Insulated and Helsby Cable Co.
Copper and bronze strip.—Charles Henderson & Co.
Wire riddles.—A. Rowat & Co.

London.—Stepney.—The B.C. has placed an order with the Improved Electric Supplies, Ltd., for 16 further arc lamps, in addition to the 60 for which the tender of the company was accepted in July last, at £1,327. The 16 additional lamps are to be supplied under a provision of the contract, for £81 per set of four lamps. The Council has also accepted the tender of Messrs. J. Richmond & Co., Ltd., at £33, for a hand lift at the generating station.

L.C.C.—The Highways Committee of the L.C.C. has received the following tenders from selected firms for an additional supply of stoneware cable ducts:—

	Number of ducts tendered for.	Price per 1,000.	Amount.
Hosea Tugby & Co. ..	150,000	£15, less 2½ per cent. discount for cash	£2,350
H. R. Mansfield	150,000	£15, less 2½ per cent. discount for cash	2,350
Stanley Bros.	400,000	£15	6,100
George Skey & Co. ..	60,000	£15	1,000

It is proposed to accept the tenders on the following basis, subject to the third and fourth firms also allowing a discount of 2½ per cent. for cash:—

	Quantity.	Price per 1,000.	Amount.
Hosea Tugby & Co.	150,000	£15, less 2½ per cent. discount for cash	£2,350
H. R. Mansfield	150,000	£15, less 2½ per cent. discount for cash	2,350
Stanley Bros.	150,000	£15	2,350
George Skey & Co.	50,000	£15	800

The tender of the Hadfield Steel Foundry Co. is recommended for acceptance by the L.C.C. for the supply of special trackwork for the tramways, at a cost not exceeding £40,000.

The following tenders have been received for the supply of (1) car-bodies, and (2) electrical equipments and assembly of cars:—

1.—Car-bodies.

	Price per car-body.	Price for 250 car-bodies.	Price for 300 car-bodies.
Hurst, Nelson & Co.	£489	£122,375	£146,850
United Electric Car Co.	512	128,000	153,600
G. R. Turner, Ltd.	523	130,750	156,900
Cravens, Ltd.	582	145,500	174,600

2.—Electrical Equipments and Assembly.

	Price for equipment for one car.	Price for erection of one car.	Price per car for trolley.	Total price without trolleys.	Total price with trolleys.
British Westinghouse Co.	£316 10	£8 0	£12 0	£97,350	£100,950
Dick, Kerr & Co. ..	314 0	20 0	15 0	100,200	104,700
British Thomson-Houston Co. ..	327 0	9 0	12 10	100,800	104,550
Siemens Bros.' Dynamo Works	317 5	24 15	(8 15) / (10 0)	102,600	(105,225 / (105,600

The tender of Hurst, Nelson & Co. is proposed for acceptance, at £122,375 for 250 car-bodies, whilst the remaining 50 car-bodies are suggested for construction by the County Council at the Leytonstone car works, at an estimated cost of £23,150.

The offer of the Westinghouse Co. is recommended for acceptance for the 300 electrical equipments, for £100,950, a proviso to be inserted in the contract that in the event of copper falling below £118 per ton, the actual price to be paid by the Council is to be based upon the market price on the first day of January, May and September respectively. The tender includes a sum of £3,600 for the provision of trolleys for the overhead system, but the exact number has yet to be ascertained. The manufacture and fitting of the car ploughs is to be undertaken by the tramways department, at an estimated cost of £3,600. Only two tenders were received for the supply of the car trucks, and fresh tenders are therefore being invited.

Marylebone.—The B.C. has placed an order with the Lancashire Dynamo and Motor Co., Ltd., for the supply of a second balancing booster for £2,200. In addition, penalties incurred by the company for the late delivery of the first booster, and amounting to £225, are to be remitted.

Melbourne (Australia).—A further order for 50 "Aston-Worsley" arc lamps has been placed with Messrs. Veritys, Ltd., by the Corporation.

Salford.—The T.C. has accepted the following tenders:—

H. S. Wood & Co.—Installing the electric light in the receiving offices at the central car depôt, £189 10s.
Cleworth & Robinson.—Foundations for turbo-generator at Frederick Road works, £575.
Brecknell, Munro & Rogers, Ltd.—Three Tierney & Malone patent automatic point controllers.
Bowes, Scott & Western, Ltd., London.—Roof over water softening plant at Frederick Road electricity works, £130.

The King's New Yacht.—"Aston" radiators, to the special designs submitted by Messrs. Veritys, Ltd., have been selected for use on the King's new yacht now being fitted up at Southampton.

Tunbridge Wells.—The T.C. has accepted the tender of the General Electric Co. for the supply of 100 50-c.p. Osram lamps.

Waterloo.—The U.D.C. has accepted the tender of Messrs. Dargue, Griffiths & Co., of Liverpool, for installing the electric light in the new library and museum, at £219.

West Ham.—The Tramways Department has accepted the tender of Messrs. S. Stone & Co. for the supply of 200 steel tires, at 26s. 10d. each. The tender of Messrs. Edgar Allen & Co. to purchase from the Council, at £100, two complete sets of tramway turn-outs has been accepted.

Woking.—The U.D.C. received the following tenders for installing the electric light in Monument Hill Schools:—

H. Quartermaine (accepted)	£67	Staples & Son	£125
A. Blatchmore	139	Foote & Milne	117

FORTHCOMING EVENTS.

To-day's Events (Friday, February 15th).—At 7.30 p.m. Institution of Electrical Engineers (Manchester Students). Mr. W. Browning on "Notes on Electrical Conductivity."

At 7.30 p.m. N.E. Coast Institution of Engineers and Shipbuilders. Meeting at Newcastle.

At 8 p.m. Institution of Mechanical Engineers. Annual General Meeting. Discussion on the Report to the Alloys Research Committee on the Properties of the Alloys of Aluminium and Copper.

Saturday, February 16th.—At 3 p.m. Royal Institution. Prof. J. J. Thomson on "Röntgen, Cathode and Positive Rays."

Institution of Electrical Engineers (Manchester Students). Visit to Liverpool and Southport Electric Railway.

Monday, February 18th.—At 7 p.m. Armstrong College Engineering Society. Mr. R. T. Sewell on "Tunnelling."

Tuesday, February 19th.—At 7.30 p.m. Institution of Electrical Engineers (Manchester). Mr. A. P. Wood on "Some New Fly-wheel Storage Systems."

At 8 p.m. Faraday Society. Mr. J. B. C. Kershaw on "The Present Position and Future Prospects of the Electrolytic Alkali and Bleach Industry."

At 8 p.m. Institution of Civil Engineers. Further discussion on Col. R. E. B. Crompton's paper "Modern Motor-Vehicles."

Wednesday, February 20th.—At 7.30 p.m. Institution of Electrical Engineers (London Students). "The Commercial Development of Electricity Supply," by Mr. W. B. Thompson.

Thursday, February 21st.—At 7.30 p.m. Institution of Electrical Engineers (Leeds). Mr. H. B. Maxwell on "Fuel Economy."

At 8 p.m. Institution of Electrical Engineers (London). Prof. J. J. Thomson on "Modern Theory of Conduction of Electricity in Metals."

At 8.30 p.m. Chemical Society. Meeting.

Friday, February 22nd.—At 3.30 p.m. Institution of Electrical Engineers (London Students). Visit to the B. of T. Laboratory, Whitehall.

At 5 p.m. Physical Society. Prof. Lyle on "Transformer Indicator diagrams"; Prof. Bragg on "Ionisation of Gases by α Particles of Radium,"; Mr. B. Roberts, "A Micromanometer."

Institution of Electrical Engineers (Manchester). Annual dinner.

At 7 p.m. Armstrong College Engineering Society. Mr. O. J. Williams on "Insulation applied to Electrical Engineering."

At 8 p.m. Electro-Harmonic Society. Ladies' Night. Concert at the Holborn Restaurant. See "Notes" to-day.

At 8 p.m. Institution of Civil Engineers (Students). Mr. F. E. Walker on "Impurities in Boiler Feed-Water; their Nature, Effect, and Elimination."

At 9 p.m. Royal Institution. Mr. D. Clerk on "Flame in Gas and Petrol Motors."

Saturday, February 23rd.—At 3 p.m. Royal Institution. Prof. J. J. Thomson on "Röntgen, Cathode and Positive Rays." (Lecture II.)

At 3 p.m. Junior Institution of Engineers. Visit to Rotherhithe Tunnel Works.

Northampton Institute Engineering Society. Visit to the Walthamstow U.D.C. Generating Station.

Association of Engineers-in-Charge. Dance.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, February 18th.—"A" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.

Tuesday, February 19th.—"B" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.

Wednesday, February 20th.—"A" Badge examination.

Thursday, February 21st.—"C" Company, technical instruction, 7 p.m.

Friday, February 22nd.—"D" Company, recruits' infantry drill, 6 p.m., technical instruction, 7 p.m.

Saturday, February 23rd.—Week end training at Tilbury for "B" Company.

Wilfrid C. Dumble, Captain R.E. and Adjutant,
Electrical Engineers R.E. (V.).

NOTES.

Institution Notes and Lectures.—Institution of Electrical Engineers (Manchester Students' Section).—The annual dinner of the Manchester Students' Section was held on Saturday, the 9th inst. Mr. S. L. Pearce presided, and about 40 members were present. The chairman, in replying to the toast of the Institution, traced its growth from the formation in 1872 up to the present time, and said that although it was a comparatively young body compared with other institutions, he thought it had considerable weight and influence in the country amongst electrical engineers and others. Mr. H. D. Symonds, vice-chairman of the Students' Section, also replied, and urged the members to keep up the numbers of the Section, also to attend regularly at its meetings, which they would find of great benefit during their future career. A good musical programme was provided, and the dinner was a distinct success.

Association of Engineers-in-Charge.—On Wednesday evening a paper on "Fuel Economics and Steam Generation" was read by Mr. W. F. Goodrich. The next discussion evening is March 2nd (Saturday), and it is then proposed to have a demonstration of lamp-testing and photometry. Messrs. Everett, Edgcumbe and Co., and the General Electric Co. will furnish the various apparatus to admit of the subject being fully treated. Sir Alexander Binnie has now become one of the vice-presidents of the Association.

Physical Society.—At the meeting held on January 25th, 1907, Prof. J. Perry, F.R.S., President, in the chair, a paper by Mr. W. A. Scoble on "The Strength and Behaviour of Brittle Materials

under Combined Stress" was read by Mr. H. S. Allen. Mr. F. Twyman exhibited a spectro-photometer and read a paper on "Recent Improvements in Spectro-photometers." Mr. K. J. Tarrant exhibited some "Photographs of Electric Sparks." The photographs were of positive and negative sparks and of discharges between parallel wires obtained by means of an induction-coil and a Tesla transformer.

Junior Institution of Engineers.—The twenty-third annual dinner of the Institution was held last Saturday at the Hotel Cecil and was attended by a large company, including some distinguished visitors, amongst whom were the Rt. Hon. Lord Farrer (Mem. of the Royal Commission on Canals and Waterways); E. B. Barnard, Esq., M.A., M.P. (chairman of the Works and Stores Committees, Metropolitan Water Board); Sir R. Melvill Beachcroft (Chairman of the Metropolitan Water Board); Sir Alexander B. W. Kennedy, LL.D., F.R.S. (President, Institution Civil Engineers); Dr. Glazebrook (President, I.E.E.); Mr. Dugald Clerk; Mr. B. Alfred Raworth, and others. The chair was taken by Mr. W. B. Bryan, President of the Junior Institution of Engineers, who in a few well-chosen words proposed the loyal toasts and "The Houses of Parliament." In replying on behalf of the House of Lords, Lord Farrer explained why Private Bills in connection with important engineering projects had to go before House of Lords Committees. Engineers, he said, required a lot of land for their schemes, and according to the laws of the country, land could not be compulsorily acquired except by the consent of both Houses of Parliament. Speaking on the passing of the canals as means of transport, Lord Farrer denied that there was any conspiracy on the part of railway directors to quench canal navigation; the question was a purely economic one, and he pointed out also how railway rates were governed by steamship competition. Mr. Barnard, acknowledging the toast on behalf of the House of Commons, referred to the chairman's remark as to the great amount of unremunerated public work done by members of Parliament like himself as members or chairmen of committees. He sometimes thought that it was hardly fair to engineers who had specialised in various branches of their profession that such work should be performed by unpaid public servants. It was probable that some deserving engineer, who had special ability or aptitude for the work, was being "done out of a job." He would like to see municipal appointments better paid, and to see at the head of State departments, such, for example, as the Local Government Board and Board of Trade, eminent engineers instead of men of the calibre of the existing presidents. In the event of such a calamity as a burst reservoir, or a railway smash, a Board of Trade inquiry would follow, and the engineer who designed the work to pass the Board of Trade requirements would, in all probability, lose his reputation and his practice. Yet the President of the Board of Trade, whilst drawing a larger salary than the engineer, would not be saddled with any responsibility. In his public work, the speaker had been much impressed by the versatility, wide general knowledge, tact and business acumen of the engineers who had appeared before the Committees.

Mr. B. A. Raworth, in a humorous and witty speech, proposed the toast of the "President of the Junior Institution of Engineers." He said that the succession of their presidents included the best men from all the Institutions, and complimented the Institution on the excellence of their president, council, and secretary. Replying on behalf of the guests to the toast proposed by Mr. L. H. Rugg (Chairman Junior Institution of Engineers), Sir R. Melvill Beachcroft, commenting on a remark of Mr. Raworth's on the subject of rates, said that the Metropolitan Water Board paid £400,000 a year in rates, which represented about 13½ per cent. on their gross income, or double this on the net income. Sir Alexander Kennedy also replied on behalf of the visitors. The popularity of Sir Alexander with the members was very apparent. He was their first president, and has always taken a close interest in the Institution. He strongly deprecated specialisation by young engineers, and urged them to take an interest in all branches of engineering, so that they could follow up any line which opened out for them. It was impossible to know everything about even one branch of engineering, even if a whole lifetime were devoted to it, and by specialising too soon in a particular groove, an engineer might find that in a few years his special line was not required, and he would get shunted into a blind siding. It was remarkable, said Sir Alexander, that the men who to-day were at the top of the tree in their special departments were generally experts in some other branch of engineering than the one they started in. Of this, Sir Alexander is a typical example; he started as a marine engineer.

The president was an ideal chairman, saying little, but always to the point; whilst sandwiched between the speeches was an enjoyable musical programme.

Royal Society.—Among the papers down to be read at last night's meeting were:—Mr. R. Threlfall, "On the Purification and Testing of Selenium." Mr. O. U. Vonwiller and Mr. W. H. Mason, "On the Specific Inductive Capacity of a Sample of Highly Purified Selenium." Communicated by R. Threlfall, F.R.S. Mr. S. W. J. Smith "On the Thermomagnetic Analysis of Meteoric and Artificial Nickel-Iron Alloys." Communicated by Sir Arthur W. Rücker, F.R.S.

Aberdeen Mechanical Society.—On the 25th ult., Mr. A. H. McKay, of the Aberdeen Corporation electricity works, delivered an address, entitled "Notes on Electric Motors," to a large and appreciative audience.

Institution of Electrical Engineers (London Students' Section).—The third annual dinner will be held at the Holborn Restaurant on Thursday, February 28th, at 7 for 7.30 p.m.

Electric Capstan Trials by the Clyde Navigation Trust.—At a meeting of the trustees, there was submitted a report by the mechanical engineer and the consulting electrical engineer on the results of the trials made at Prince's Dock, extending over a year, with the new patent electric capstans, as compared with the ordinary hydraulic and electric capstans, with the object of determining the most suitable type for the remaining 30 or thereabouts, that will ultimately be required for Clydebank Dock. There was also read a report by the traffic superintendent, stating that, from observations of its working, the new capstan was, in his opinion, more efficient than those of the ordinary type. The Committee, being satisfied that the patent capstan was better than the ordinary capstan as regards working, efficiency and economy, agreed to adopt it. The tenders for the supply of six of the patent capstans were submitted and examined, and, after consideration, it was agreed to recommend acceptance of the tender of Stothert & Pitt, Ltd., at £230 each, being the lowest, but before doing so the Committee instructed Messrs. Stothert & Pitt's price to be got for 12, and remitted to the convener and Mr. Gilchrist to authorise 12 to be ordered instead of six, if they deemed the reduction in price reasonable.

A G.E.C. "At Home."—The staff of the General Electric Co.'s Glasgow branch held their "At Home" on Thursday, 7th inst., at the Arcade Café. About 120 sat down to table under the chairmanship of Mr. Warde, who was ably seconded by Mr. Sims, after which the evening was occupied with music and dancing, which were kept up with great spirit till close on midnight.

Meter Testing.—In our advertisement pages to-day will be found particulars of rules and scale of fees in connection with the testing of electric meters by the L.C.C.

Electric Shock Fatalities.—A settlement has been effected in the action by Wm. Melville against the Glasgow Corporation for damages in respect of the death of his son, who was killed in Stirling Road sub-station of the electricity department while interfering with the switches on the high-tension switchboard, and the action has been taken out of Court. The terms of settlement have not been disclosed.

Robertson Fire Brigade.—On Saturday last the members of the Robertson Fire Brigade held their annual dinner at Brook Green Hotel, W. The dinner was succeeded by a smoking concert, and a very enjoyable programme was gone through. During the evening Mr. Wilson congratulated the fire brigade on their excellent work, and on their success in the various competitions in which they had engaged. Mr. Ralph replied on behalf of the brigade, and said that they owed their success mainly to the support and encouragement which the firm gave to their employés on every occasion. The fire brigade have been the winners this year of the City of London Challenge Shield, the L.P.F.B.A. Championship Cup, and the Hitchcock Challenge Shield. A large number of friends were present.

Parliamentary.—Ireland.—Several provisional orders will be sought in the coming Parliamentary Session in connection with Irish electrical undertakings. These include Carrickfergus Electric Lighting, Cork Rural District Electric Lighting, and the Cavehill and Whitewell Tramway Bill. The last is to secure running powers over the Belfast Corporation system.

Hull Tenders.—In regard to the question of the tenders for new plant, referred to in our last issue, the matter seems to have given rise to considerable discussion at a recent City Council meeting. We are glad to note that the Committee's recommendation to discriminate against British plant has been referred back by a majority of 30 votes to 12.

Appeal Allowed.—Dudley Tramway Case.—In the Court of Appeal on Wednesday last week, an appeal by the Dudley, Stourbridge and District Electric Traction Co., Ltd., from a judgment of Mr. Justice Swinfen Eady in an action which they brought against the Dudley Corporation, was heard. On the following day, Lord Justice Williams gave judgment allowing the appeal. He said that no one disputed that the word railway embraced the use and occupation of the fabric as well as the fabric itself, and no one denied that the word "railway" in this case was capable of that meaning. The actual subject matter of sale was the goodwill of No. 5 Railway. Section 63 modified Section 4, and the former section authorised the transfer, not merely of the railway structure, but the transfer of it as a going concern, with the power of carrying on the undertaking. What was sold was a railway as a going concern, using the word "railway" in its wider sense. Lords Justices Farwell and Buckley concurred, and the appeal was allowed accordingly.

Woolwich Electricity Undertaking.—The Electricity Committee has issued a report on the electricity undertaking, containing the comments of Sir A. B. W. Kennedy on the scheme. The Committee recommends the closing of the wiring department as from March 31st next. The chairman of the Finance Committee has stated that the only solution of the financial difficulty in connection with the undertaking is to levy a special rate, which may amount to 8d. in the £. The late chairman of this Committee has expressed the opinion that a 10d. rate will be required.

(*Continued on page* 271.)

THE NECAXA POWER PLANT, MEXICO.

While North America is the home of big things in the way of hydro-electrical plants and long-distance transmissions at high pressures, up to the present Mexico has not figured prominently in such developments.

A most extensive undertaking of this character has, however, recently been inaugurated in the vicinity of the City of Mexico, by the Mexican Light and Power Co., a Canadian venture, which is calculated to assist largely in the coming industrial development of the locality.

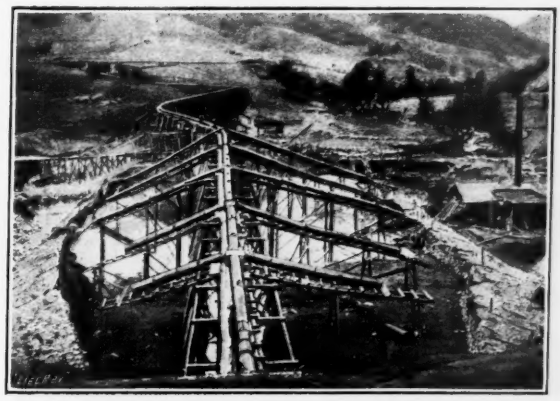
At about 90 miles north-east of the City of Mexico, the rivers Tenago and Necaxa issue from the mountains, at a height of some $\frac{3}{4}$ mile above sea level, subsequently joining and flowing 70 miles eastwards to the sea; and a series of falls are formed, having a total drop of 4,500 ft. in 10 miles.

In the initial development of the water power, the river Tenago was diverted into the Necaxa River by a 40-ft. dam and a tunnel 3,000 ft. long, the joint flow being stored in a reservoir at Necaxa with a capacity of 1,585,000,000 cb. ft.

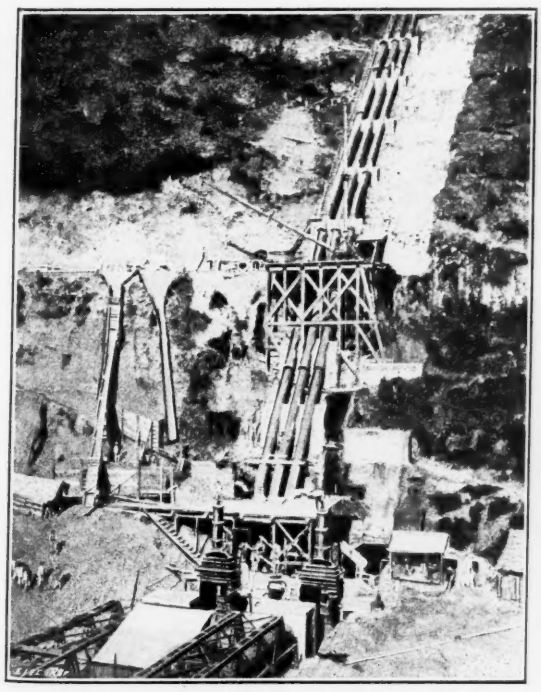
From this reservoir a series of pipe lines and tunnels carry water to the first power plant, with a drop of 1,470 ft. in a mile.

An interesting point in regard to the provision of the dams was that they were constructed by the "hydraulic fill" method, a system originating in California. In this system the materials of construction are cut away from the neighbouring hills by means of a stream of water, which carries them down a sluiceway into a flume supported on trestles over the site to be occupied by the dam. The materials discharge through pipes on either side of the flume, the discharge taking place near the embankment, so that the boulders and gravel are deposited on the faces, and the fine mud and water in the centre of the dam.

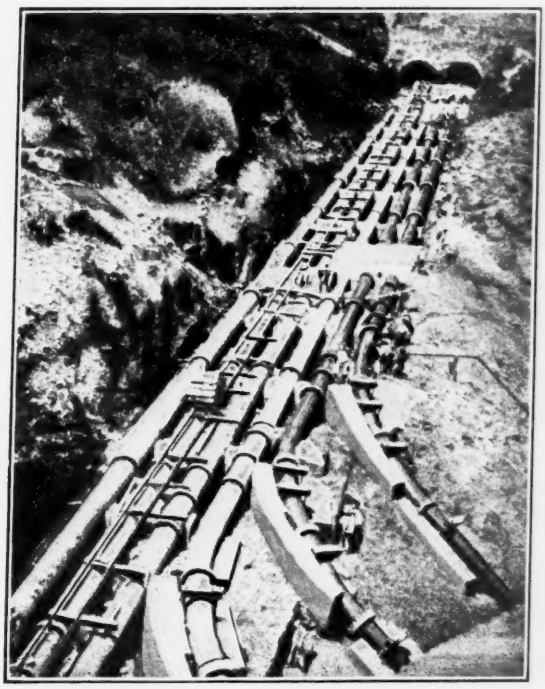
From the Necaxa reservoir, two riveted steel pipes, each 8 ft. diameter and $\frac{3}{8}$ in. thick, subsequently reduced to 6 ft. diameter, lead to two receivers, each 22 ft. long and 7 ft. diameter, and from the latter six 30-in. pipes pass down to the power house, a distance of some 2,460 ft., 1,900 ft. of which lies in two parallel tunnels constructed at an angle of 41° with the horizontal.



Dam Construction, Necaxa, by the "Hydraulic Fill" Method.



Pipe Line and Receivers under Construction.



30-in. Pipes Entering the Power House.

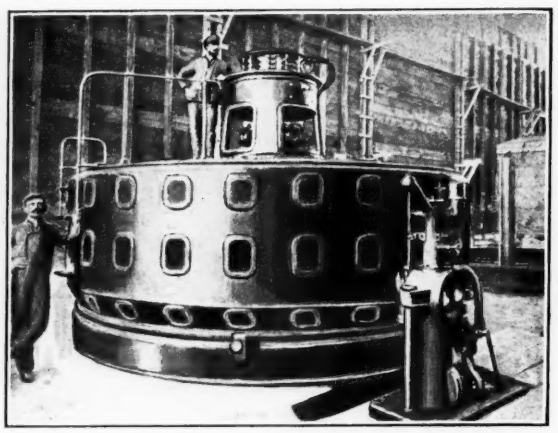
On the 30-in. pipes, 30-in. diameter relief valves are provided, pipes from which lead up the hillside, some 310 ft., to an elevation above the crest of the dam.

Two expansion joints of the diaphragm type are provided

in each 6 ft. pipe line, and packed slip-joints in each 30 in. pipe line.

The 30-in. pipes and flanges were forged complete from one piece of sheet steel, two cast-steel clamping rings being slipped on behind the flanges, through which 22 bolts of $1\frac{1}{4}$ in. diameter were subsequently fitted for clamping purposes; the pipe thickness varies from ·4 to ·95 in. at the lower end.

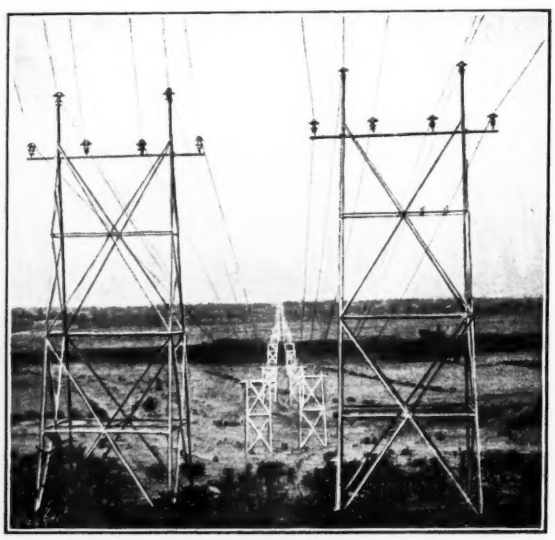
The pipe lines pass into the basement of the power house building, which is located in the canon below the lower Necaxa Fall, with its vertical drop of 740 ft., and terminate in 28-in. valves operated by hydraulic power.



5,000-kw. Vertical Shaft Generator Unit, Necaxa.

The power house is a steel and concrete building standing on a concrete foundation: one half is devoted to the wheels and generators, and the other, in two storeys, is occupied by transformers and switchgear.

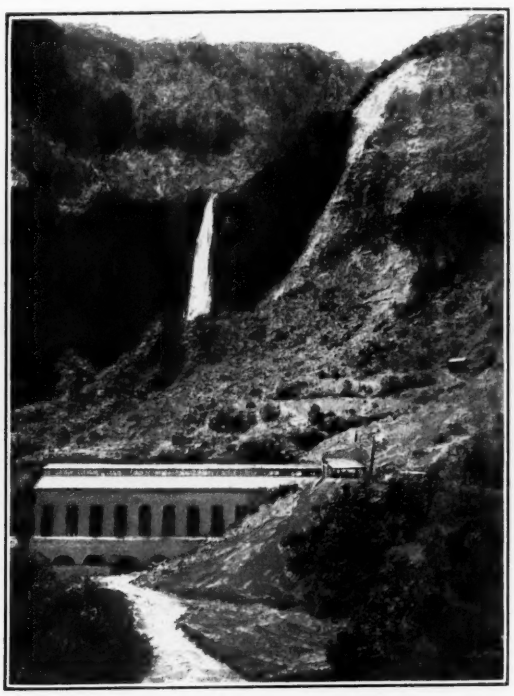
The hydraulic plant installed consists of six vertical shaft impulse-wheels, normally rated at 7,000 h.p., but with a maximum output of 9,000 h.p. The wheels are of 100 in. pitch dia. and run at 300 r.p.m.; each has 24 steel buckets clamped to a solid cast-steel centre, and is provided with two regulating nozzles, coupled together and to a by-pass valve on the end of the pipe line, and arranged so that when the nozzles open the valve closes, and thus keeps



View of the Four 10,000-kw. Transmission Lines.

the flow of water constant, avoiding water shocks. A 14-in. dia. shaft carries both wheel and generator, supported at its lower end by a 30-in. thrust bearing, under which oil at 150 lb. pressure is pumped.

It is claimed that the double nozzle, in reducing the size of jet and bucket, enables a smaller wheel of higher speed and unimpaired efficiency to be used; furthermore, the two nozzles,



The No. 1 Necaxa Power House.

being on opposite sides of the wheel, reduce the thrust on the bearings.

A governor controls the valves, admitting oil from a pump to the thrust bearing, and water from the penstock to

60,000-volt and Telephone Insulators, Necaxa Transmission.

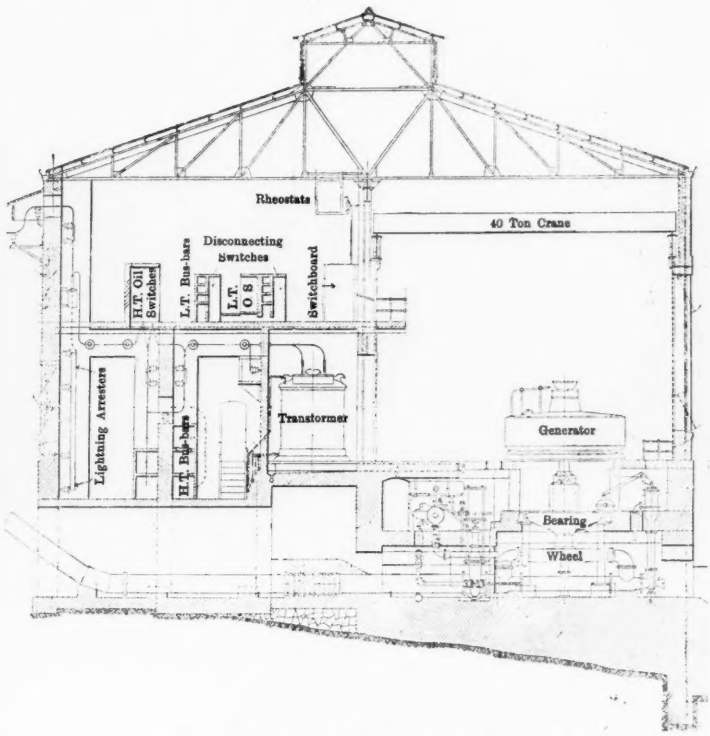
the pistons which operate the nozzles and by-pass. The electrical generating plant consists of six 5,000-kw. revolving field three-phase alternators, generating at 4,000 volts pressure and 50 cycles. Two direct connected 60-kw.

exciters and two 250-KW. induction motor-driven exciters supply energy for excitation at 125 volts pressure.

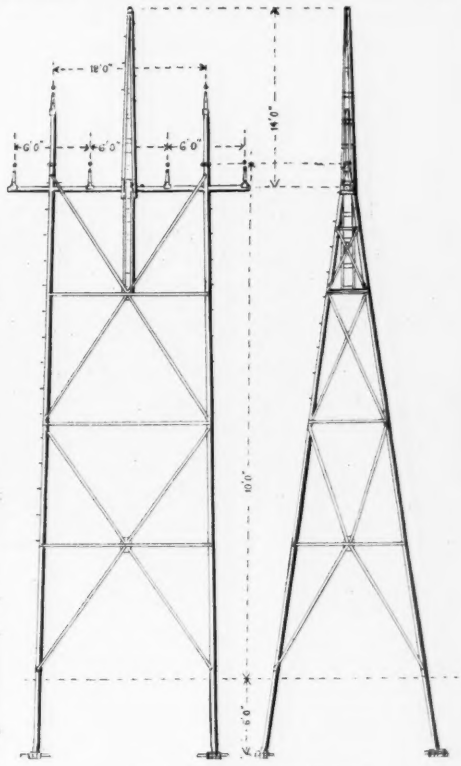
Exciting sets taking power from the main units were used in preference to wheel-driven units, on account of the small nozzles used with the latter, getting choked.

open instantaneously a short-circuit of the entire power system. They are also equipped with disconnecting air switches, so that the oil switches and other devices can be cut off from the system for repair and inspection.

The oil switches are on a gallery, with the controlling



CROSS-SECTION THROUGH THE NECAXA POWER HOUSE.

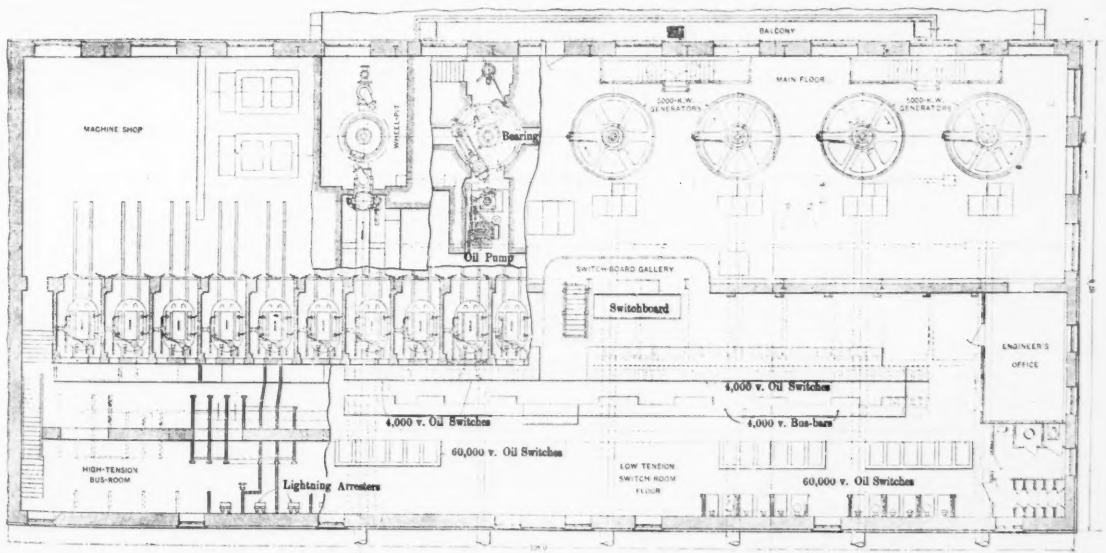


STEEL TRANSMISSION TOWER.

Energy from the generators is fed to five banks of water-cooled transformers, each consisting of three 2,000-KW. units arranged to step up the pressure to from 40,000 to 60,000 volts for transmission purposes.

The transformers are placed in a closed fire-proof compart-

switchboard in the centre, where the operator can obtain an unobstructed view of the machinery. The small controlling switches for the large oil switches, with the miniature lamps which indicate their position, are mounted on a bench-board with dummy bus-bars to form a wiring diagram, so that the



PLAN OF THE NECAXA NO. 1 POWER HOUSE, SHOWING ARRANGEMENT OF WHEEL PITS, GENERATORS, SWITCHGEAR, &C.

ment, separated from the generator room by steel bulkheads, on account of the large quantity of oil used for insulation.

The wiring consists of insulated cables in conduits and bare wires in brick and concrete compartments, and a substantial concrete wall isolates every wire, switch or lightning arrester. The main switches are all of the oil type, controlled electrically from a distance, and any switch will

attendant can always see how the apparatus is connected, and thus avoid mistakes.

On vertical panels, above the bench-board, are the indicating instruments which show at any instant the speed, potential and power at which the plant is operating. These instruments are also placed in such a manner, with relation to the dummy busses and operating switches, that the

operator cannot become confused. At the back of the board are the registering instruments which record the pressure and output of the plant. The switchboard forms a room surrounded by ornamental ironwork, with the instruments and controlling devices on the outside.

Four 60,000-volt power transmission circuits, on two tower lines, connect the power house to the City of Mexico sub-station, and two circuits connect the latter to the sub-station at El Oro for supplying the gold and silver mines in the district.

The distance from Necaxa to Mexico is 94 miles, and from Mexico to El Oro 75 miles: the total length, therefore, will be 169 miles, making it the longest power transmission in regular operation. The loss in the transmission circuits between Necaxa and Mexico, with 100 per cent. power factor at 60,000 volts, will be 8 per cent. at full load, so that the entire power can be delivered over two of the four circuits, or one-half the transmission system, with only 16 per cent. loss, should the other half be disabled. The loss in transmission from Mexico to El Oro is only 5 per cent.

The circuit-breakers at Necaxa, Mexico, and El Oro are arranged to cut out automatically any transmission circuit which becomes damaged, without interruption to the power service.

The transmission towers are built up of steel angles, heavily galvanised, and are 58 ft. high over all; the transmission cables are supported on 14 in. diameter porcelain insulators, at a height of 40 to 46 ft. above ground, and are triangularly disposed, 6 ft. apart.

A 14-ft. extension above the tower, carries a galvanised steel cable with lightning arrester to protect the apparatus from damage.

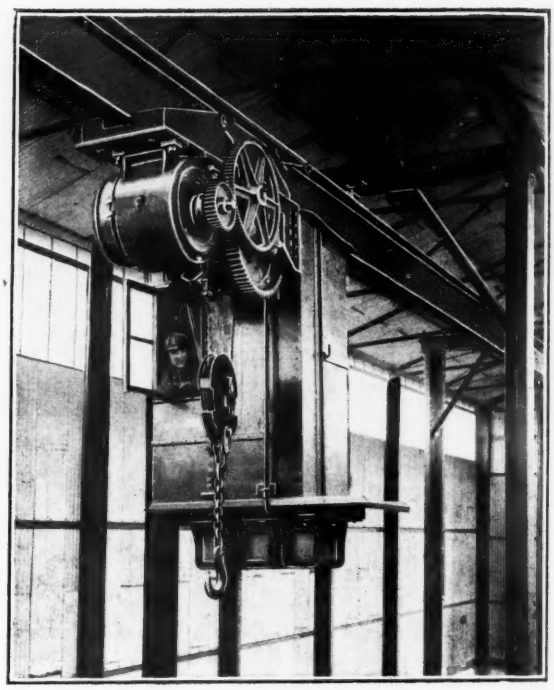
The standard spacing of the towers is 500 ft., but spans up to 1,500 ft. are made with higher towers.

The steel towers offered greater facilities for transportation and a longer life in Mexico. The long spans also reduced the number of insulators. The latter are made in three parts, cemented together, and cemented on to a 2-in. steel-pipe pin which is fitted on to a 4-in. pipe cross-arm in the case of the lower conductors, and on a 3-in. pipe extension for the upper ones. The insulators were tested to 120,000 volts pressure.

The conductors are six-strand copper cables, $\frac{1}{2}$ in. diameter, with hemp centres, and are attached to the insulators by bolted clamps, no tie wires being used. Duplicate telephone lines are supported on the towers, 10 ft. below the power transmissions.

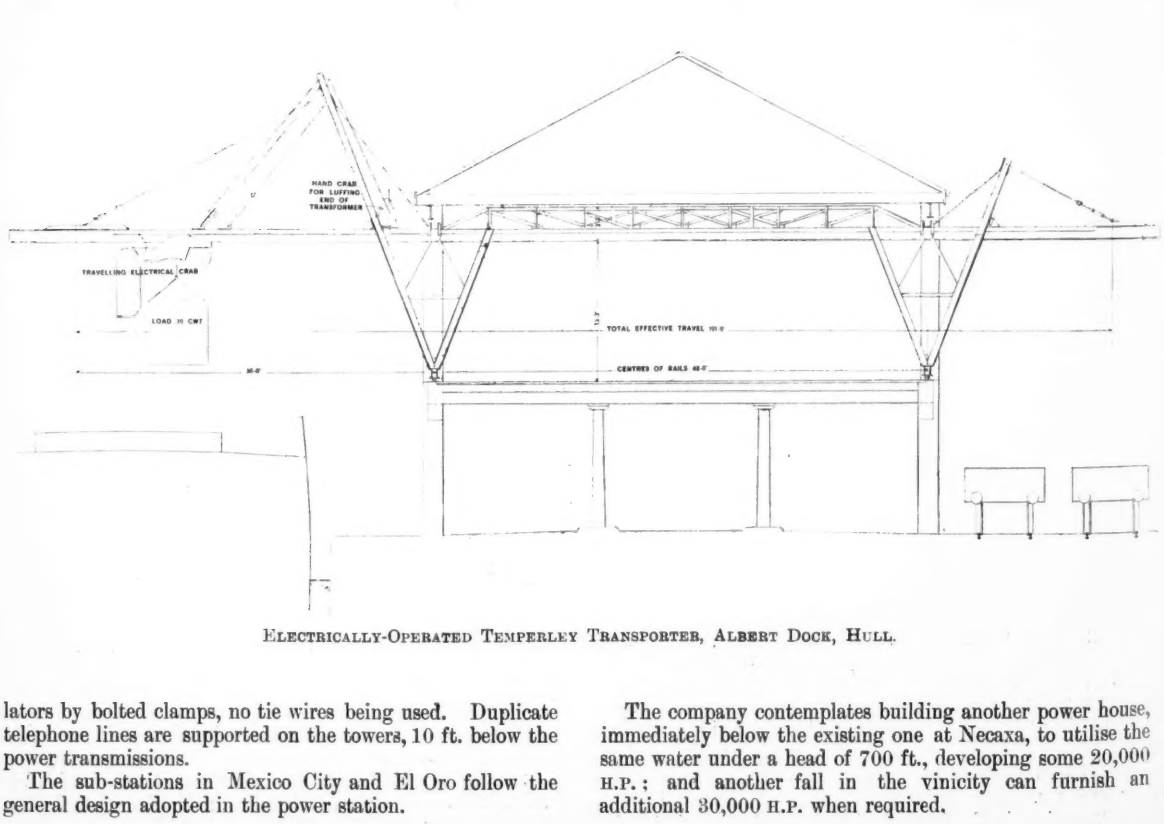
The sub-stations in Mexico City and El Oro follow the general design adopted in the power station.

The Mexico building contains 16 1,800-kw. step-down oil transformers and the necessary switchgear, in fireproof cells, arranged to furnish energy at 1,500, 3,000 and 6,000 volts pressure for use in the city, where the cheaper power from Necaxa is taking the place of an existing supply from four steam-driven plants.



The Temperley Electric Traveller.

The El Oro sub-station contains nine similar 1,800-kw. step-down transformers, for the local distributions at 3,000 and 6,000 volts pressure.


HAND CRAB FOR LUFFING END OF TRANSFORMER
TRAVELLING ELECTRICAL CRAB
LOAD 20 CWT
TOTAL EFFECTIVE TRAVEL 101-0"
CENTRES OF RAILS 48-0"

Electrically-Operated Temperley Transporter, Albert Dock, Hull.

The company contemplates building another power house, immediately below the existing one at Necaxa, to utilise the same water under a head of 700 ft., developing some 20,000 h.p.; and another fall in the vinicity can furnish an additional 30,000 h.p. when required.

In conclusion, we may mention that the pipe lines were supplied by the Actien Gesellschaft Ferrum, of Kottowitz, Germany; the impulse wheels by Escher-Wyss & Co., of Zurich; the generators by the Siemens Schuckert-Werke, Berlin; and the transformers and switchgear by the G.E. Co. of America.

CARGO HANDLING BY ELECTRICAL TRANSPORTERS.

On page 270 we illustrate the type of transporter which has just recently been installed by the Temperley Transporter Company at the Albert Dock, Hull, to the designs and specifications of Mr. T. M. Newell, the chief engineer for docks of the North-Eastern Railway Co. Each installation consists of a movable bridge transporter constructed for lifting maximum gross loads of 1½ tons of general merchandise. The transporter beam is of such a length as to afford a total transporting distance of 101 ft., made up of a central span of 48 ft., an over-reach of 35 ft. on the water side, and 18 ft. on the land side. The arm over the water is made to hinge up so as to clear the masts and rigging of vessels passing or coming alongside. On the beam runs a "Temperley" electric traveller driven by an electric motor, series wound, for running on a 220-volt continuous current circuit, and complete with reversible controller and resistances. The motor drives through spur gearing, the hoisting and transporting motions—both motions being provided with a powerful hand brake. The electric controller and all of the operating levers are assembled in a driver's cab suspended from the traveller, and as the driver journeys on the electric traveller with the load, he has complete control over all of the operations, and can lift and lower his load at any desired point with the greatest exactitude. The beam over the water is lifted and the whole plant is travelled sideways along tracks, by hand gearing. With these transporters, the handling of cargo at the Albert Dock, Hull, has been greatly facilitated, and economies effected in the dock labourage. Goods can be discharged from the vessels into the shed, or through the shed into the railway wagons or carts beyond, whilst the loads may, in the reverse direction, be taken from the railway wagons (or carts) on the far side of the warehouse, transported into the shed, or through to the vessel lying alongside the dock. The speeds specified by the North-Eastern Railway Co.'s dock engineer were 200 ft. per minute for both lifting and transporting operations, and these requirements, we understand, have not only been fully met, but have, in actual working operations, been exceeded.

NOTES.

(*Continued from page* 266.)

L.C.C. Tramways and Income-Tax.—The presentation of a report on this subject by the Finance Committee, at Tuesday's meeting of the Council, led to a long debate of an electioneering character in relation to the finances of the tramways. It was stated in the report, which dealt with the assessment of the southern tramways for income-tax on profits under Schedule D, that the amount of the assessment was £89,249 in 1899-1900, £64,488 in 1900-1, £69,197 in 1901-2, £48,922 in 1902-3, £77,773 in 1903-4, £165,943 in 1904-5, and £203,831 in 1905-6, the latter three years being subject to deductions. In explanation of this point the Committee stated that the assessment for 1903-4 was subject to an allowance for renewals on conversion from horse to electric traction, a question which was now under appeal. The assessments for 1904-5 and 1905-6 were subject to similar allowances, and to allowances, which should be considerable in amount, for depreciation, and were also subject to the Inland Revenue authorities accepting as working expenses certain items charged in the accounts. The tax had been paid on the amounts shown above for the first four years, and for the remaining four years sums amounting to £14,710 had been paid on account, pending the settlement of outstanding questions as to the before-mentioned allowances; and it was probable that the figures of assessment for the last three years would be reduced in the end. The report proceeded to state that the figures related to assessments under Schedule D only. Income-tax was paid under Schedule A upon tramway property (depôts, offices, &c.), and the amount of the assessments under A was, in accordance with the usual income-tax practice, deducted before arriving at the assessment under D, which represented what was virtually the surplus on working after deducting the amount of Schedule A assessments. The taxed tramway income was applied by the County Council in the first place to the payment of interest upon the debt incurred for the undertaking, and in the second place to the payment of the annual instalment in liquidation of the debt, and any balance was carried to a reserve fund, or applied in relief of rates or carried forward. In accounting to the Inland Revenue authorities for the income-tax deducted by the Council from interest on its consolidated stock, the Council was allowed to retain so much of such tax as represented interest paid out of income already taxed. Interest upon the money borrowed for the tramways undertaking was chargeable against the tramways income, and the Inland Revenue, therefore, would get tax twice over on the same income if the deduction and retention of tax on the interest were not allowed. In effect, the Council paid tax upon so much of the surplus on working the tramways as remained after deducting the proportion of such surplus as was applied to the payment of interest upon capital. The deduction in respect of interest on borrowed money was necessarily much larger in the case of the Council's undertaking than in the case of a company's undertaking, because the Council had borrowed the whole of the capital required for the undertaking, whereas, in the case of a company, only a relatively small proportion (if any) of its capital would be loan capital. In comparing the financial results of the working of the Council's undertaking with those of a similar undertaking in the hands of a company, the true comparison must be between the net earnings of the two undertakings before the same were applied, in the case of the Council to the payment of interest on capital, repayment of capital or otherwise, and in the case of a company to the payment of interest on loan capital and dividends on share capital. The amount of income assessed to tax under schedule D afforded, therefore, in the opinion of the committee a fair standard of comparison of the results of working the two classes of undertakings.

The Loughborough Strike.—It was stated in Wednesday's *Standard* that the strike at the Brush Co.'s Works was giving way. The men have been out about three months, and are gradually returning to work on the employers' terms.

Electro-Harmonic Society.—The next concert (ladies' night) is to be held on the 22nd inst. at the Holborn Restaurant, commencing at 8 p.m. The vocalists on this occasion will be Miss B. Cartwright, Miss C. Herwin, and Mr. G. Gardner. The orchestra will be responsible for the instrumental music, and the names of Miss J. Mayell, Mr. F. Rome and Mr. T. Clare are on the programme to supply the humorous element.

Fire at Burnley.—On January 29th a serious fire broke out at the extensive premises of J. R. Cooper & Co., cotton manufacturers, Burnley. The buildings include an engine room, boiler house, weaving shed, a large room with preparation machinery such as sizing, taping machines, and a rope works. The fire broke out in the boiler house, and this, together with engine room, sizing and taping room were practically ruined, and all the machinery in them, but the weaving shed and rope works were very little damaged. Negotiations were immediately entered into with the Corporation Electricity Supply Department to run these portions with motors off the Corporation mains. The work was put in hand immediately, and part of the machinery was started up again on February 5th, seven days after the fire. There will be in all a total of about 250 H.P. installed, and an agreement has been entered into between Messrs. Cooper and the Corporation for a 12 months' supply.

Bristol Tramways Ambulance Class.—At the invitation of Mr. Samuel White, J.P., managing director of the Bristol Tramways and Carriage Co., Ltd., the members of the recently-formed Tramways Ambulance Class met on Saturday evening, the 26th ult., at Chivers's Restaurant, Promenade, Clifton, for supper and for the presentation of the certificates gained by those who successfully passed the examination in "First Aid to the Injured." In the unavoidable absence of Mr. White, the meeting was presided over by Mr. Charles Challenger, traffic manager. In addition to the 51 certificated members, there were present Dr. J. S. Griffiths, Knight of Grace of the Order of the Hospital of St. John of Jerusalem in England, who was the examiner of the class; Dr. C. A. Hayman, superintendent of the Bristol Brigade of the Ambulance Association, and who delivered the course of lectures to the Tramways Ambulance Class; Dr. G. H. Barker, Tramways M.O.; Dr. E. V. Foss, Deputy M.O.; Mr. Geo. Matthews, manager, carriage department; Mr. H. F. Cooper, secretary; Mr. Henry White Smith, accountant; Mr. Sydney E. Smith, assistant traffic manager; Mr. G. H. Challenger, motor-'bus department; Mr. F. Strong, car works department; and Messrs. Cotton, Greenland and Roberts, ambulance officers, who gave practical tuition in first aid work to the class in conjunction with the lectures. After supper the president referred to the pleasure it gave him to be present at the inauguration of the Tramways Ambulance Class, and complimented the members on their success in the examination, no less then 52 having gained certificates out of 54 candidates. He called upon Dr. C. A. Hayman to present the certificates.

A lengthy programme of vocal and instrumental music was gone through.

British Commission for the Milan International Exhibition.—A meeting of the Milan International Exhibitions Committee was held at the London Chamber of Commerce on the 11th inst., the President (Sir Albert Rollit) in the chair. There

were also present Mr. A. Serena, Honorary Executive Commissioner; Lord Brassey, Honorary President; Sir Thomas Brooke-Hitching, Mr. Thomas Cope, Mr. Imre Kiralfy, Mr. Edwin O. Sachs, Mr. E. Ristori, Mr. Arthur J. Giles, Mr. G. Briggs, Mr. C. Rozenraad, Mr. C. Pavin, Mr. E. Canziani, Mr. C. Busk, Mr. J. H. Polak and Mr. Kenric B. Murrey (Honorary Secretary). The Chairman said the Finance and other Committees had met that morning and had finally gone through the accounts, which would be presented to the Commission and would show a surplus of upwards of £4,000. Medals had been received and would be presented by the Commission to the successful exhibitors. The success of the British exhibitors had been great, and the percentage of high awards which they had received through the juries was remarkable. The Executive Commissioner read the accounts in detail, and various payments to the staff and others were ordered to be made. The Executive Commissioner also presented the draft report of the Commission, to be made to the Government, and it was resolved to consider this at a future meeting.

The Electrical Engineers R.E. (Vols.)—The annual dinner of the Sergeants' Mess was held at the Café Monico, on Saturday, February 9th, under the presidency of Q.M.-S. Applebee. There was a fair attendance both of members of the mess and of representatives of other corps. After the toast of the King had been duly honoured, the President proposed "The Officers." Major H. M. Leaf and the other officers present briefly responded. The toast of the "Permanent Staff" was then submitted by C.S.M. Marshall in a few well chosen words. Capt. Dumble, R.E. (the Adjutant of the Corps) in reply said that, under ordinary circumstances, this would be the last time he would address the mess as their adjutant. It had always been his aim to promote men best suited for that position to the rank of non-commissioned officer. In the regular army, obedience to and reliance on their officers were driven into the men by a painful process, so that in times of stress and strain they looked to these officers to direct them. This was not possible in its entirety in the auxiliary forces, and it was therefore necessary to promote those men who were used to leadership. He thanked the other members of the staff and the mess generally for the way in which they had co-operated with him in his work. At the conclusion of the dinner a successful musical programme was carried out under the direction of Sergeant Kibble.

West Ham Corporation Electricity Works Dinner.—On Thursday last week the first annual dinner of the staff of the electricity supply department was held at Liverpool Street Hotel. There was a large attendance, and an excellent programme of music and songs was provided, mainly by the staff. Mr. A. Hugh Seabrook, chief electrical engineer, presided, supported by the Mayor and Mr. Alderman Littler.

After the loyal toast, Mr. F. E. Harris, the borough treasurer, proposed "The Mayor and Corporation of West Ham," and spoke of the energy of the borough and the great work accomplished by the Corporation. The electricity department had helped to stimulate industry by cheapening electrical energy. West Ham had grown very rapidly, and the Corporation had done its best for the borough; perhaps it had done too much and too quickly, but better times were coming. The Mayor, Ald. Spratt, in reply, pointed out that West Ham was the seventh borough in the kingdom in size; though its history was comprised within 21 years, it had provided itself with every public service or institution that was possessed by any borough in this country. The rates were high, but the municipal debt was the lowest of all the great towns. He complained that too great a burden of cost for education was thrown upon the borough under existing conditions. There was a great future for the borough, which possessed large and increasing industries, and encouraged them.

Ald Littler proposed the health of "The Engineer and Manager and the Electricity Department" in a lengthy speech, eulogising the enthusiasm of the engineer, who had re-organised the department and got the utmost out of his staff. Mr. Seabrook, he said, was as much a commercial man as an engineer—an essential qualification nowadays. In his reply, Mr. Seabrook expressed his gratitude to the committee for its complete confidence in him, without which success was not possible, and to his assistants—Messrs. Masters, Hunt, Eustace, Rockley and others—whose work was beyond praise.

Mr. J. Eustace proposed "The Visitors," for whom Mr. F. A. Stern and Mr. J. K. Bock replied, the latter urging the Corporation to pay good salaries to their staff—a point on which he felt keenly. Finally, Mr. F. J. Masters proposed "The Press," and Mr. R. W. Weekes and Mr. Davis briefly replied.

The function was very successful, and seems likely to become a hardy annual.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. G. Holdsworth, of the Bradford Corporation electricity department, has been appointed to the post of junior assistant engineer in the electricity department of the Keighley Corporation.

Mr. G. B. Burrows, assistant mains superintendent of the Rochdale Corporation electrical engineers' department, has been appointed assistant mains engineer to the Durham Collieries Electric Power Co., Ltd.

Mr. W. B. Adams, senior engineer-in-charge at the Croydon electricity works, was presented with a clock by members of the staff on Thursday last week, he having resigned his appointment to take up duties at the Marylebone electricity works.

The Gravesend and Northfleet Electric Tramway Staff has presented a gold ring and silk umbrella to Mr A W Kipping, the manager, in recognition of his services in organising social gatherings for the staff.

The Bradford Corporation Electricity Committee has appointed Mr. H. S. Ellis, deputy electrical engineer at Cardiff, as deputy electrical engineer, at a salary of £250 per annum.

Mr. John B. Prickett, electrical engineer at Burry Port, was married on February 6th to Miss K. Jones, second daughter of Mr. F. Jones, of Broadhaven.

The Rochdale T.C. has increased the salary of Mr. C. C. Atcheson, electrical engineer, from £300 to £350 per annum.

On Tuesday last week Mr. A. G. H. Davis, station superintendent at Exeter electricity works, who has resigned the post to take up the appointment of electrical engineer at the Gun and Shell Factory, Cossipore, Calcutta, India, under the Indian Government, was presented with an address and a Webley revolver and attachments; in making the presentation Mr. Munro referred in eulogistic terms to Mr. Davis's ability and energy.

The Farnworth U.D.C., Lancs., at the last Council meeting unanimously arranged to give Mr. R. B. Leach, their chief electrical engineer and general manager, a three years' agreement, with a progressive advance in salary of £15 the first year, £30 second, and £50 the third year, in recognition of his abilities, and of the steady progress of the Farnworth undertaking, which, we are informed, is now showing a substantial profit. Extensions are contemplated in the near future, and these Mr. Leach will design.

On the 1st inst., Mr. T. E. Mott (chief clerk) was presented with a cut-glass trifle bowl, mounted on a suitably inscribed silver salver, by the staff and workmen at the Bridlington Electricity Works, on the occasion of his marriage. The presentation was made by Mr. Arthur J. Beckett, borough electrical engineer.

Mr Victor A. H. McOowen, who was appointed electrical engineer to the Salford Corporation, tendered his resignation to the Belfast Tramway and Electric Committee on the 11th inst. The Committee expressed its regret at his departure from Belfast, where he had so successfully laboured in connection with the electric lighting and tramway conversion. The Corporation offered him a position equal in value to his new appointment, in order to retain his services.

By 17 votes to 7, Warrington T.C. has increased the salary of the electrical engineer (Mr. F. V. L. Matthias), from £300 to £350 per annum.

The E.L. Committee of Battersea B.C. make the following propositions in regard to the electric lighting staff:—That Mr. A. White, station superintendent, be allowed the use of a portion of the residence at the central station, occupied by the late chief electrical engineer, with electric light and fuel, without any deduction from his present salary, viz., £140 per annum; that the salary of Mr. T. Bennett senior shift engineer, be increased from £117 to £130 per annum; that the salaries of the other shift engineers be increased from £104 to £117 per annum. All the foregoing increases are to have effect from January 1st last. Mr. W. Mears, meter superintendent, is to be placed on the staff at his present salary—£117 per annum. The following scale of salaries for shift engineers is to be adopted:—Commencing salary £117, rising to a maximum of £150.

Tramway Officials.—Blackburn T.C. has increased the salary of Mr. J. H. Cowell, tramway manager, from £260 to £300 per annum, with further annual increments of £20, to a maximum of £400.

General.—Mr. A. W. Beuttell has resigned his appointment as chief engineer to the North Wales Power and Traction Co., and has now taken up special work in connection with the technical and commercial development of patents and inventions. He will shortly make a trip to America on business of this nature, and on his return will open an office in London. His address, *pro tem.*, will be 6, Mount Nod Road, Streatham, S.W.

The Council of the Society of Arts attended at Marlborough House on 7th inst., when the Prince of Wales, president of the Society, presented the Society's Albert Medal to Sir Joseph Wilson Swan, F.R.S., for the important part he took in the invention of the incandescent electric lamp, and for his invention of the carbon process of photographic printing.

Mr. C. S. Northcote informs us that the Electrical Manufacturers' Association have appointed Mr. F. Nalder and Mr. H. Oppenheimer to serve as their representatives on the advisory committee of the Wholesale Electric Traders (2, Queen Anne's Gate), and that the Electrical Contractors' Association have appointed Mr. Rashleigh Phipps and Mr. W. R. Rawlings in a similar capacity to represent their interests.

NEW COMPANIES REGISTERED.

Saldanha Bay Harbour and Railway Co., Ltd. (91,627).—This company was registered on January 11th, with a capital of £157,500 in 150,000 ordinary shares of £1 each and 150,000 deferred shares of 1s. each, to acquire the business and assets of the Saldanha Bay Harbour and Estate Co., Ltd., of Cape Town, including its freehold property and right to continue the Bills before the Cape Parliament for the construction of harbour works at Saldanha Bay and of a railway from the harbour to Porterville Road, to construct railways, tramways, waterworks and electric lighting and supply stations, to adopt an agreement with J. Dykes, &c. The available net profits are to be applied *(a)* in paying a preferential dividend of 7½ per cent. on the ordinary shares, and *(b)* in paying on the deferred shares an amount equal to the aggregate sum of such preferential dividend. Any balance is to be divided equally between the ordinary and deferred shares. The first subscribers (each with one share) are:—G. Beeson, 1, Roxwell Road, W., clerk; H. Sorrell, 152, Hainault Road, Leytonstone, N.E., clerk; E. Sorrell, 152, Hainault Road, Leytonstone, N.E., clerk; Amy M. Hesketh, 6, Sundorne Road, Old Charlton, Kent, clerk; C. E. Fayle, 3, Royal Parade, Muswell Hill, N., clerk; J. Buckingham, 38, Ratcliff Road, Forest Gate, E., clerk; and A. Peckover, 72, Nigel Road, Forest Gate, clerk. Minimum cash subscription 5,000 ordinary shares. The number of directors is not be less than two or more than five; the subscribers are to appoint the first; qualification, 250 ordinary shares; remuneration, £100 each per annum (£50 extra for the chairman) and 5 per cent. of the distributed profits in each year, payable only out of surplus remaining after 7½ per cent. is paid on the ordinary shares and an equal aggregate amount on the deferred shares, such percentage not in any case to exceed £1,000 in any year. Registered office, 20, Copthall Avenue, E.C.

Dynamic (French) Syndicate, Ltd. (91,809).—This company was registered on January 25th, with a capital of £8,200 in 800 preference shares of £10 each, and 4,000 ordinary shares of 1s. each, to adopt an agreement with H. Lacy, to acquire any inventions and rights for France and the French Colonies and possessions relating to the production, treatment, storage, application, distribution and use of electricity or to apparatus or appliances therefor, and to carry on the business of suppliers of electricity for light, heat and power, electricians, engineers, garage keepers, manufacturers of and dealers in electric cars and carriages or other electrically-driven vehicles, &c. The first subscribers are:—T. H. Weguelin, 18, Clifford Street, W., gentleman, 800 preference and 1,300 ordinary shares; H. Lacy, Kelvin, Carshalton, engineer, 2,000 ordinary shares; B. H. Weguelin, Coombe End, Kingston Hill, gentleman, 100 ordinary shares; L. W. P. Chetwynd, Coombe Nevile, Kingston Hill, Commander R.N. (retired), 100 ordinary shares; D. H. Allan, 20, Copthall Avenue, E.C., chartered accountant, 100 ordinary shares; A. Goodlet, 6, Parkhill, Carshalton, chartered secretary, 200 ordinary shares; and J. Green, 5, Parkhill, Carshalton, engineer, 200 ordinary shares. No initial public issue. The number of directors is not to be less than two or more than seven: the first are T. H. Weguelin, B. H. Weguelin, Commander L. W. P. Chetwynd, J. Green and D. H. Allan. So long as H. Lacy holds one-third of the ordinary shares he may appoint a director, the said B. H. Weguelin being his first nominee; qualification (including such nominee), 100 shares; remuneration, 50 guineas each per annum and 5 per cent. of the surplus net profits after 5 per cent. is paid on the preference, and 5s. per share on the ordinary shares, divisible. Registered office, 6, Broad Street Place, E.C.

Mawdsley's, Ltd. (91,783).—This company was registered on January 23rd, with a capital of £20,000 in £1 shares, to take over the business of electrical engineers, carried on by R. A. Lister & Co., Ltd., at Rivers Mill, Dursley, Glos., together with the said premises, to acquire and exercise patents Nos. 6,666, of 1902, and 9,604 and 21,972, of 1903, and all other patents, inventions, rights and privileges granted to J. H. St. H. Mawdsley by an indenture dated May 16th, 1904, between himself and the Zone Dynamo and Motor Patents Co., Ltd., and to adopt agreements (1) between R. A. Lister & Co., Ltd., of the one part and J. H. St. H. Mawdsley of the other part, and (2) between the said company of the first part, the said J. H. St. H. Mawdsley of the second part, and W. J. Ashworth of the third part. The first subscribers (each with one share) are:—R. A. Lister, The Towers, Dursley, agricultural and electrical engineer; R. A. Lister & Co., Ltd., Dursley; C. A. Lister, The Priory, Dursley, agricultural and electrical engineer; J. H. St. Hill Mawdsley, Heskin, Taunton, electrical engineer; A. H. Hunking, Tilsdown, Dursley, accountant; W. J. Ashworth, Parsonage Street, Dursley, accountant; A. A. Lister, The Towers, Dursley, agricultural engineer; and J. Mawdsley Gibbons, Beechcroft, Mossley Hill, Liverpool, iron merchant. Minimum cash subscription, £2,000. The number of directors is not to be less than four or more than five; the first are R. A. Lister, C. A. Lister, J. Mawdsley Gibbons, and J. H. St. H. Mawdsley (all permanent). Should either R. A. Lister or C. A. Lister cease to be a director, R. A. Lister & Co., Ltd., may, if holding 5,000 ordinary shares, appoint a successor; qualification (except nominees of R. A. Lister & Co., Ltd.), £500; remuneration (except managing director), £40 each per annum; C. A. Lister to receive a further £50 per annum for special services. The said J. H. St. H. Mawdsley is managing director for five years with £250 per annum and a further £250 in any year in which the ordinary shares receive a dividend of 10 per cent. All the original shares are ordinary. Registered office, Zone Works, Dursley, Glos.

Platinum Substitutes, Ltd. (91,766).—This company was registered on January 22nd, with a capital of £50,000 in £1 shares, to acquire from C. O. Bastian and G. Calvert the benefit for all parts of the world of certain inventions relating to sealing metallic conductors into or through glass, to turn the same to account, and to carry on the business of electricians, makers of cables, wires, lines, accumulators and lamps, suppliers of electricity, glass and metal workers, &c. The first subscribers are:—C. O. Bastian, Bartholomew Works, Kentish Town, N.W., with 500 shares; M. Harrison, Stock Exchange, E.C., stockjobber, with 1 share; P. S. Sykes, 33-4, Broad Street Avenue, E.C., chartered accountant, with 1 share; T. A. Burdett, Stock Exchange, E.C., stockbroker, with 1 share; W. Mathieson, Stock Exchange, E.C., stockbroker, with 1 share; A. M. Lewis, Stock Exchange, E.C., stockjobber, with 1 share; P. Vandervell, Stock Exchange, E.C., stockbroker, with 1 share; and G. Calvert, 27, Barrett's Lane, Stoke Newington, N., electrical engineer, with 500 shares. No initial public issue. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £100; remuneration, two guineas each per board meeting attended (chairman three guineas) and 5 per cent. of any net profits in excess of 50 per cent. on the paid up capital, divisible.

Eastern Electrical Syndicate, Ltd. (91,760).—This company was registered on January 22nd, with a capital of £10,000 in £1 shares, to acquire concessions for the establishment of electrical power and light stations in England and elsewhere and to carry on the business of electrical and electric light and power supply engineers, tramway proprietors, contractors, &c. The first subscribers are:—R. C. Portheim, 2, London Wall Buildings, E.C., engineer, with 100 shares; R. A. Fremantle, 77-80, Palmerston House, E.C., stockbroker, with 100 shares; T. W. Stratford-Andrews, Cecil House, Wimbledon Common, S.W., gentleman, with 100 shares; R. C. Pearman, 21, Old Square, Lincoln's Inn, W.C., barrister, with 100 shares; W. R. Brooke, 219, Knightsbridge, S.W., late Indian Telegraph Department, with 100 shares; W. H. Stentiford, 1, Broad St. Place, E.C., chartered secretary, with one share; and J. H. Jennings, 1, Broad St. Place, E.C., clerk, with one share. No initial public issue; the first directors are not named; qualification, 100 shares. Registered office, Broad St. Place, E.C.

Sedneff Batteries, Ltd. (91,769).—This company was registered on January 22nd, with a capital of £1,500 in £1 shares, with objects chiefly indicated by the title. The first subscribers (each with one share) are:—H. M. Cordry, 6, Dundalk Road, Brockley, S.E., clerk; J. E. Simister, 11, Ironmonger Lane, E.C., clerk; G. Rowson, 55, Great James Street, Marylebone, N.W., clerk; R. B. Cannings, 81, Camilla Road, South Bermondsey, S.E., clerk; A. W. Read, 11, Ironmonger Lane, E.C., solicitor; J. Bolton, 175, Friern Road, East Dulwich, S.E., clerk; and L. Downes, 11, Ironmonger Lane, E.C., chartered secretary. No initial public issue. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, one share; remuneration as fixed by the company.

J. H. Street, Ltd. (91,826).—This company was registered on January 26th, with a capital of £500 in £1 shares, to acquire the business of electrical engineers, cycle and fishing tackle dealers, &c., carried on at Unicorn Hill, Redditch, by J. H. Street, and to carry on the same and the business of suppliers of electricity, manufacturers of and dealers in railways, tramway, electric, magnetic, galvanic and other apparatus, &c. The first subscribers (each with one share) are:—J. H. Street, Unicorn Hill, Redditch, electrical engineer; Miss F. M. Thomas, 6, Hewell Road, Redditch; J. E. Wilkes, 10, Milne Street, Redditch, traveller; A. Thornton, 57, Lodge Road, Redditch, foreman; H. Guillaume, Clive Road, Redditch, manufacturer; C. E. Layton, 21, Melen Street, Redditch, manager; and W. Allen, The Shrubbery, Prospect Hill, Redditch, electrical engineer. No initial public issue. Registered without articles of association.

Seagers, Ltd. (91,906).—This company was registered on January 31st, with a capital of £30,000 in £1 shares (21,000 5 per cent. cumulative preference), to adopt an agreement with F. H. Seager for the acquisition of the business carried on as "L. J. & C. Seager," with freehold and leasehold land, buildings, plant, stock, &c., appertaining thereto, and to carry on the business of consulting, mechanical, marine, electrical and general engineers, boilermakers, founders, smiths, ironmongers, &c. The first subscribers (each with one preference share) are:—F. H. Seager, Overy House, Dartford, engineer; Miss E. D. Seager, Overy House, Dartford; C. H. Gilbert, 12, Carlton Road, Sidcup, engineer; Mrs. E. Gilbert, 12, Carlton Road, Sidcup: H. Brier, 1, Miskin Road, Dartford, engineer; Mrs. V. M. Brier, 1, Miskin Road, Dartford; and W. M. Newton, Summerhill Cottage, Dartford, stationer. No initial public issue. The number of directors is not to be less than two, or more than five; the first are F. H. Seager, C. H. Gilbert and H. Brier; qualification, £500; remuneration as fixed by the company. Registered office, Overy Street, Dartford.

Robstone Lamp and Illuminating Co., Ltd. (91,845).—This company was registered on January 28th, with a capital of £2,000 in £1 shares, to adopt an agreement with F. A. Mitchell-Hedges, A. B. U. Robson and A. Kevan, and to manufacture and deal in the "Robstone" and other electric lamps and all apparatus and things used in connection with the diffusion of electric light, including standards, brackets, reflectors, electric signs and illuminations, &c. The first subscribers (each with one share) are:—F. A. Mitchell-Hedges, 110, Fenchurch Street, E.C., contractor; A. B. U. Robson, 110, Fenchurch Street, E.C., merchant; A. Kevan, 120, Fenchurch Street, E.C., accountant; Mrs. L. A. Mitchell-Hodges, 70, Claverton Street, Westminster; W. H. Cherry, 110, Fenchurch Street, E.C., merchant; Mrs. P. H. P. Robson, Royston Park, Pinner; and J. Stone, 110, Fenchurch Street, E.C., merchant. No initial public issue; registered without articles of association. Registered office, 120, Fenchurch Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London Sherardising Co., Ltd. (89,533).—This company's annual return was filed on December 15th, when 16,000 shares had been taken up out of a nominal capital of £20,000 in £1 shares. £3,000 has been received, and £13,000 is considered as paid. Mortgages and charges: Nil.

General Electric Sign and Engineering Co., Ltd. (90,297).—This company's statutory report, dated December 19th (filed December 20th), shows 1,510 shares taken up and paid for in full out of a nominal capital of £2,000 in £1 shares. No mortgages or charges registered.

Sevenoaks Motor-Car and Electrical Co., Ltd. (90,070).—This company's statutory report, made up to December 15th, shows 2,000 preference and 2,508 ordinary shares taken up out of a nominal capital of £6,000 in 2,000 preference and 4,000 ordinary shares of £1 each. £1 per share has been called up on 2,508 ordinary and 2,000 preference are considered as fully paid. No mortgages or charges registered.

Electrical Industries Development Co., Ltd. (89,461).—This company's annual return, made up to October 23rd last, was filed on January 7th. 7 shares have been taken up out of a nominal capital of £25,000 in 20,000 preference and 5,000 ordinary shares of £1 each. £7 has been received. Mortgages and charges: Nil.

Kuprom, Ltd., electro-depositors, Clapham and Kennington (87,749).—Particulars of £3,000 debentures, created January 2nd, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, have been filed pursuant to Section 14 (4) of the Companies Act, 1900. No trustees.

Benton, Keighley & Reynolds, Ltd., chemical, electrical and general engineers, Fulham (84,661).—Issue on January 18th of a £250 5 per cent. debenture, part of series created November 16th, 1906, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital, ranking in priority to previous series. No trustees. Previously issued of same series, £750.

Britannia Electric Lamp Works, Ltd. (London; registered in 1903) (77,908).—A memorandum of satisfaction in full of debentures dated March 3rd, 1905, securing £210, has been filed. Consent has been given for the registration of a latter company, the Britannia Electric Lamp Works (1905), Ltd.

Lumb Electrical Bleaching Co., Ltd. (Edenfield) (91,562).—Issue on January 19th of £14,200 5 per cent. first and £11,725 6 per cent. second debentures, parts of series created January 18th, 1907, to secure £15,000 each. Property charged: The company's undertaking and assets, present and future, except uncalled capital. No trustees. No previous issue of either series.

Electric Vehicles Development Co., Ltd. (90,213).—The statutory return, dated December 7th (filed December 12th) show 612 shares taken up and paid for in full, out of a nominal capital of £1,000 in £1 shares. Up to January 10th £1,610 debentures (part of £3,000 authorised) had been issued.

Allan Electrical Syndicate, Ltd. (69,257).—This company's annual return was filed on January 31st, when 660 shares had been taken up out of a nominal capital of £1,000 in £1 shares. £600 has been received and £60 is considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Bristol Tramways and Carriage Co., Ltd.

Sir Geo. White presided on 6th inst. at the annual meeting held at the Grand Hotel, Bristol. In moving the adoption of the report (see Electrical Review, February 1st, p. 197), he said that in the carriage department the traffic receipts had increased by £12,547, but the tramway department produced £3,104 less. The

total revenue showed a net increase of £10,027. The forage account was smaller by £1,271. The total general expenses were £28,734, against £27,772, the difference being in rates and taxes. In the item of renewals and maintenance there was an additional outlay of £1,600. The money spent in maintaining the permanent way, rolling stock, and other items of equipment, amounted in the year to £49,342, against £47,737 in the corresponding period. The total expenditure for the year was £176,461, leaving a profit of £90,307, against £85,080 in the corresponding period, and with the exception of the year before last this was the largest profit they had ever made. During the year they expended something over £55,000 in adding to their lines, properties and equipment. It included the outlay on the Filton extension, the new motor-'bus depôt there, the cost of the motor-'buses so far delivered, and of some properties they had purchased in Bristol. The total number of passengers carried during the year was 46,902,257, an increase of 1,608,080 passengers. Of course, they would understand that this large increase in the number of passengers carried was due to the motor services which they commenced during the past year, and which the report informed them would be still further developed when the omnibuses now on order were delivered. It was probable that some would expect him to enter into the question of the cost of working motor-omnibuses, but there was no immediate object to be served by any dissertation on the subject. Their experience went to show the ability of the omnibuses to carry a large volume of traffic, and they were giving them a thorough test and securing for themselves much practical acquaintance with their handling, though he might point out that whilst work of this kind was in its experimental stage, and one of the main objects was the testing the adaptability and character of such vehicles to perform the work expected of them, the percentage of working expenses must necessarily be high. Their experiments had been most interesting, and they would continue to give this growing branch of their business their careful study and attention in the hope that with patience and money, perhaps a good deal of both, a satisfactory outcome might be secured. During the past year they had constructed the tramway extension from the Horfield terminus along the main road to Filton, and intended opening it for public traffic this month. This was one of the lines where they had a period of 42 years undisputed possession. They believed the district would develop rapidly, and felt assured that the outlay in this extension would well repay them. During the year they had made two departures in extending workmen's cars and reducing the working period of the traffic staff from 10 to 9 hours per day.

Charing Cross, West End and City Electricity Supply Co., Ltd.

MR. FLADGATE presided at the extraordinary general meeting held on 7th inst., and he moved a resolution approving the new Bill referred to in our last issue. He said that the Bill was being promoted by all the existing London electric lighting companies. They did not think that so very much more energy was wanted than at the present moment was given. A very large proportion of the horse-power within the area of the existing London companies was now being supplied with electric energy, and a very much greater proportion than was suggested by Mr. Merz. The L.C.C. had lodged a Bill seeking to become the authority to supply London with energy in bulk. He, for one, did not think that for some years to come there was any necessity whatever for any further stations being put down to supply energy in bulk. The existing stations of the London companies had, at the present moment, at least 25,000 KW. of energy available for supplying the wants of the manufacturer. The normal increase of London was not more than 8,000 KW. per annum; therefore, they had got practically three years' supply in hand at the present moment among the London companies. In the existing stations of the London companies, without the erection of further buildings, there was available space to put down machinery for a further 50,000 KW. There was no need for an independent body to put down a new station at present, when they had in hand something like three years' supply, and the potential power, at a very small expense, of creating energy in London to supply at least seven or eight years. The London companies were proposing to reduce the maximum price for bulk supply to the manufacturer to a figure which was practically the same as that which had been suggested by Mr. Merz. In return for this concession they asked to be allowed to supply each other or the local authorities with energy, and, if necessary, to link up their existing stations. That was only what was some time back practically suggested to them by the Board of Trade.

Imperial Tramways Co., Ltd.

SIR GEORGE WHITE presided at the annual meeting held at Bristol on 6th inst. In moving the adoption of the report (see ELECTRICAL REVIEW, February 8th, page 236), he referred to the company's holding in the L.U. Tramways (1901), Ltd. That company's report had not yet been issued, but their colleague, Sir Clifton Robinson, who so ably directed its operations, told him that the total receipts were larger than ever, being £327,838, and that the profits exceeded those of any former year, whilst the company were busily engaged in carrying out the linking up of their system, *viâ* Wimbledon, with the London County Council's South London electric tramways system, and the opening of these additional through routes between London and Surrey and Middlesex could not fail to have an important and beneficial effect upon the traffic of both these large systems.

The report was adopted. At a special meeting that followed, Mr. H. C. GODFRAY explained the company's proposals for constructing a tramway and widening and altering roads in the North Riding of York County. The meeting approved the proposed Bill.

Baker Street and Waterloo Railway Co.

THE directors' report submitted to the half-yearly meeting held on Tuesday, shows that the expenditure on capital account during the period amounted to £87,578. The revenue receipts from all sources amounted to £44,580. The working expenditure, so far as it was payable by the company, was £33,328 14s. 1d. The charges for maintenance and administration are payable by the Underground Electric Railways Co. of London, Ltd., until the construction of the railway has been completed. The balance carried to the credit of net revenue is £11,253. The number of passengers carried since the opening of the railway has been as follows:—

Half-year ending.	Number, including estimated journeys by season ticket holders.
June 30th, 1906 (16 weeks)..	3,006,276
December 31st, 1906..	6,799,895

The opening of the Great Northern, Piccadilly and Brompton Railway on December 15th has placed many important parts of London, extending from Finsbury Park in the north to Hammersmith in the west, in direct and rapid communication with the places served by this railway, and the exchange of passengers at Piccadilly Circus already shows that the public appreciate the value of the new facilities, and are using them in numbers which increase each week as the existence of these facilities becomes better known. The adoption of differential fares, instead of a uniform 2d. fare for all stations, which took place on July 22nd last, has resulted in a satisfactory increase both of traffic and revenue. Through bookings are now in operation with the District, the Great Northern, Piccadilly and Brompton, the Metropolitan, the City and South London and the London and South-Western Railways, and the through traffic is increasing satisfactorily. The interchange of passengers with the Central London Railway at Oxford Circus also shows a steady growth. The proposed extension from Edgware Road to Paddington has not yet been commenced, but the matter is under consideration. The company owns 3 m. 5·3 f. constructed, and there are 1 m. 4·7 f. constructing or to be constructed. The passenger train-mileage for the half-year was 414,598, and the car-mileage 1,100,032.

Mr. T. J. HARE presided at the meeting. In proposing the adoption of the report, he said that dealing first with the capital account, a further amount of £100,000 debenture stock had been created, and £4,400 raised, and an additional £12,008 had been received on the ordinary shares. The capital expenditure during the half-year was £87,577 10s. 4d., and the estimated expenditure on that account for the current half-year was £200,000. During the half-year they had carried 6,799,895 passengers, and had received £44,263 12s. 7d.; the average number of passengers per week had been 261,535, and the average weekly traffic receipts £1,702 18s. 11d., against 187,892 passengers, and £1,452 18s. in the previous four months, during which the railway was opened, whilst for the last six weeks since January 1st, the average number of passengers had been 379,064, and the receipts £2,357, showing that the public were at length learning to use the railway and to avail themselves of the great facilities it offered them for getting to almost any part of London by the interchange with other railways with which it was connected. The traffic of the past week was a record—£2,445. £316 12s. 3d. was received for transfer fees and sundries. The total working expenses were £33,327 14s. 1d. exclusive of charges paid by the Underground Railways Co. under their construction contract. Power cost £11,918 13s. 2d.; repairs of rolling stock, £862 2s. 9d.; traffic expenses, £17,017 1s. 2d. compensation, £15 13..; and passenger duty, £194 18s. 3d. As he stated last half-year that duty was a most unfair tax on the tube railways, which were in competition with omnibuses and tramways that had no passenger duty to pay. Their fares were very low, averaging a little over 1½d. per passenger. They were also heavily rated, the amount paid in the half-year for rates and taxes being £3,319 5s. 9d. The balance carried to net revenue was £11,252 10s. 9d., to which was added £3,008 8s. 8d. for interest and rents. To pay interest on debenture stock and certain rents payable by the company required £14,578 10s. 5d., so that there was a deficiency of £317 10s. 7d., which had been paid by the Underground Co. The extension to Edgware Road would be opened about July, and might be expected to bring a considerable additional traffic to the railway. The shareholders would be glad to hear that the differential fares introduced on July 22nd had brought to them additional traffic and revenue. Taking the first week after the opening of the Elephant and Castle extension, which was their complete line at present in operation, and the last week of the past half-year, it was found that the traffic on 1d. fares increased 76 per cent., on 1½d. fares 72 per cent., while the increase on traffic on fares at 2d. and upwards during the same period had amounted to 18 per cent. In addition, during the half-year through bookings had been put into operation, and they now had a traffic of about

50,000 passengers a week exchanged with other lines. The exchange of passengers with the Central London Railway at Oxford Circus station continued to show a satisfactory and healthy increase. He thought they might look forward to a steady increase in the traffic, and he hoped that next February he might be able to submit to them accounts showing far more satisfactory results than those for the past six months. They could carry double the number of passengers with comparatively little increase in cost, so that any improvement in receipts would practically be profit.

Sir Algernon West seconded the motion.

The Hon. R. Lubbock asked what the company was paying per unit for its electric current, and when it expected to get it at a lower cost.

The Chairman, in reply, said the price was under 1d. per unit, but when all the tube lines were open they would be able to say really what the current was costing them. When that time arrived there would be a considerable reduction. The extension to Paddington was still under consideration, and it might be some time before it was proceeded with. He could not say whether the Underground Co. would consider the line to be still "under construction," and continue to pay the dividend. As to extending the line further into the western suburbs, such as Cricklewood, the board at present were not in favour of doing anything in that direction.

The report was then adopted.

Waterloo and City Railway Co.

The half-yearly meeting of this company was held on Thursday last week at Waterloo Station, S.E. Sir Charles Scotter presided.

The Chairman, in moving the adoption of the report (see Electrical Review, page 236), said that as that was their final meeting he would not pass any comments upon the report. The railway came into existence under an Act of Parliament in 1893. There was no doubt that it had met a want, for no fewer than 41,000,000 passengers, inclusive of season ticket-holders, were carried since the line was first worked. Not one of those passengers had met with any accident. Some time back a lady met with an accident whilst alighting from one of the trains, but that was through carelessness; and except with that one exception, no injury had been caused to any one of those 41,000,000 passengers. There had been no mishaps, and very few delays in the electrical running of the cars had occurred. The longest stoppage had been one of about 12 minutes, and there had been some minor delays of three and four minutes; but, on the whole, the time kept had been very satisfactory. Like Anthony, he had come there "Not to praise Cæsar, but to bury him." As they knew, the Waterloo and City Railway had now been taken over by the London and South-Western Railway, and all the negotiations for the transferring of the company had been carried out most satisfactorily.

Lieut.-Col. the Hon. H. W. Campbell seconded the motion, and the report was adopted.

In reply to a Shareholder, the Chairman said that the electric power station built for supplying the power to the trains was erected by the Waterloo and City Railway, and the London and South-Western Railway had taken that over with the other fixtures and properties of the Tube Railway.

Anglo-American Telegraph Co., Ltd.

The ordinary general meeting of this company was held on Friday last at Winchester House. Mr. Francis A. Bevan presided.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 237), said he wished to congratulate the shareholders on the fact that they were able to pay a final dividend for the whole year of £1 12s. 6d. on the ordinary stock, and £1 15s. on the deferred stock. The traffic receipts for the past half-year amounted to £210,000, as against £198,000, an increase of about £12,000. They had earned the unusual large sum of £12,800 from repairs to cables, &c., executed by their ss. *Minia*. A large amount of interest had accrued owing to the rate of interest which the bankers were paying them. The increase over the corresponding period of 1905 was, therefore, £20,580, but the working expenses during the same period showed an increase of £3,429, chiefly on account of the ordinary increases in salaries. From the first half-year, the shareholders would remember the directors brought forward £19,094, so that the company had now at its disposal the sum of £115,000 for distribution, as against £74,000, and thus they were able to pay the dividends he had previously mentioned. No doubt that was extremely satisfactory, but when they looked at the items carefully they would see that by no means a large portion of that sum was owing to their ordinary traffic. The increase was due to a large extent to the earnings of the *Minia*—£20,800, and they no longer took £20,000 out of the reserve fund to put to the renewal account. As he had told them on many a previous occasion they could not rely upon the *Minia*, for the steamship earnings were so varied and uncertain. There had been one or two breaks in the cables, but they were not serious. The breaks had occurred mostly where the water was shallow and not in the deep sea. They found that where a cable broke in deep water it was generally accounted for by the action of modern trawlers, for in many cases they dragged their nets over the cables, and as a result the cable broke. Of course it was very difficult to prove that such was the case, but that was so. Turning to the renewal fund account, they would notice that they had during the year replaced the shore end of the "1873" cable. Last year he told them that they thought the cost of repairing it would be £25,000, but, as a matter of fact, the work had been done at a little over £20,000. They had had a lot of trouble with this particular cable, but he was glad to say that it was now in a good condition. In all they had replaced about 80 miles of the line, and he thought it would well repay them for the outlay. They would also see from the renewal account that they had had £6,592 repaid to them by the income-tax authorities. They had for many years been in conflict with the authorities as to what basis they should be assessed on, and they had come to an arrangement which was for 10 years—whereby they were charged on the cost of their cables, steamship, &c. They had been able to recover the amount overpaid to the authorities during the past two years, and, of course, they would be better off in the future. Their renewal fund balance now stood at £1,009,000, which was only £9,000 over the amount at which it was agreed to fix the renewal fund. The securities were marked at cost price in the account, so that if they should ever have to sell them they would not fall short of the price named—£1,009,000—by many pounds. But the sum was none too large, for when they remembered that some of their cables were first laid in 1873 and 1874 it would not be an unlikely event if they should break, and if that did happen it would make a big hole in their balance. During the year their staff had worked with assiduity, and even though they might have finance, they could not succeed unless they had the co-operation of their staff. There were two things which were necessary to a business like theirs—to get hold of as much traffic as possible, and to secure the interest of their staff. In conclusion, he again congratulated the shareholders on the success which had attended the year's working.

Mr. Charles Burt seconded the motion, and the report was adopted.

British Aluminium Co., Ltd.

An extraordinary general meeting of the above company was held at Winchester House, E.C., on Thursday last week under the chairmanship of Mr. J. D. Bonner, when the following resolutions were submitted:—

(1) That the capital of the company be increased from £700,000 to £1,300,000 by the creation of 40,000 6 per cent. "A" cumulative preference shares of £5 each and 40,000 1908 conversion shares of £10 each. (2) That the said 40,000 6 per cent. "A" cumulative preference shares shall rank for dividend and in all other respects *pari passu* with the existing 6 per cent. "A" cumulative preference shares in the company. (3) That the 1908 conversion shares shall entitle the holders thereof to interest at the rate of 5 per cent. per annum on the amounts for the time being paid up thereon, such interest to be payable out of the net profits of the company available for distribution by way of dividend on the share capital of the company, subject to the prior payment thereout of the dividends on the whole of the 6 per cent. "A" cumulative preference shares and on the 7 per cent. preference shares and on the 4 per cent. funding certificates of the company and on the conversion shares created by extraordinary resolution on April 30th, 1906 (until such conversion shares shall be sub-divided and converted as provided by the said resolution). (4) That on December 31st, 1908, or so soon thereafter as the 1908 conversion shares are fully paid up, each share shall (subject to the passing of the necessary resolutions therefor) be sub-divided into two shares of £5 each, one of which shall be a 7 per cent. preference share ranking in all respects *pari passu* with the existing 7 per cent. preference shares of the company, and the other shall be an ordinary share ranking in all respects *pari passu* with the existing ordinary shares of the company.

The Chairman, in moving the resolution, said that when he last met them he explained that for some time the demand for aluminium had been in excess of the supplies of the metal, and that they were pressing forward vigorously with the great power scheme they had in progress at Loch Leven, but that some considerable period would have to elapse before those works reached a producing stage. Shortly after they heard of a partially developed station in Norway, and to obtain some supplies they decided to acquire it. Later in the year they took steps to develop speedily some 3,000 h.p. at Loch Leven which would be done without interfering with the general scheme, with the result that they were hoping to produce aluminium in three months' time there. In addition they decided to acquire another power of considerable magnitude, and last July purchased the concession of water power at Orsières in Switzerland, having first obtained a favourable report from their engineers. The amount of power to be obtained from that was considerably greater than what they expected to get from Loch Leven, and they were advised that the capital cost per horse-power would be less. They intended to proceed with the construction of works without delay, and he was pleased to tell them that Mr. E. Sawyer, who had had a large experience of water-powers and electro-chemical industries on the Continent, had been elected to join the board and become president of the Orsières Power Co. These new departures entailed a large capital expenditure, and in addition they had also to erect subsidiary works to utilise the large amount of power which they would ultimately possess. Their expectation, when all the schemes were fully developed, was that they would have upwards of 70,000 h.p. It was likely that, with the increasing power being utilised in America and on the Continent, the existing famine in aluminium ought to be succeeded by a plethora of the metal which would lead to a material reduction of the present prices. Meanwhile the company was enjoying a great period of prosperity. Later on, even if the price fell, they would obtain satisfactory results if there was a sufficient expansion of the demand for the metal. Whatever happened they regarded water powers of the size being developed at Loch Leven and in Switzerland as being sound and remunerative investments. If there were a lower price they looked forward to a great increase in the use of the metal in many directions, and especially for electrical purposes. As near as they could estimate they would want about £800,000 to carry out the programme he had indicated, but they would only require the money gradually over the next four or five years. The £600,000 they proposed to raise in the manner stated in the resolution, and the remaining £200,000 would probably be provided for by the further exercise of their borrowing powers.

Mr. Wolfenden seconded the motion, and it was agreed to.

Dublin and Lucan Electric Railway Co.

The directors' report for the half-year ended December 31st, 1906, says that the gross receipts for the period were £3,320, being substantially similar in amount to those of the corresponding period of 1905. After providing for debenture interest there is an available balance of £1,119, out of which the directors recommend the payment of the usual half-yearly dividend on the 5 per cent. preference shares, and that the balance of £644 be carried forward to next half-year. The directors recommend that the preference dividend be payable on March 15th.

The mileage worked electrically is seven. The train mileage for the half-year was—

Half-year ended December, 1905.		Half-year ended December, 1906.
56,700	Passenger trains, and mixed passenger and goods trains.	50,526
1,178	Goods trains.	4,263
57,878		54,789

The London Electric Supply Corporation, Ltd.

The report of directors for the year ended December 31st, 1906, says that the profit on working is £56,522, to which has to be added interest on deposit and the amount brought forward, £3,284, less expenses incurred in Parliament last session, viz, £1,388, making a total of £58,418. Out of this the interest on debenture stock to December 31st, viz., £14,976, has been paid, leaving a balance of £43,442. The board propose to pay a dividend of 6 per cent, on the preference shares for the year (of which an interim dividend of 3 per cent. was paid on September 1st, 1906), viz., £20,952; to pay a dividend of 4 per cent. on the ordinary shares for the year, £13,320; to place to reserve account (making a total of £55,000) £5,000; and to carry forward £4,170. The supply of current for power and lighting has been efficiently maintained during the year. The number of units sold amounted to 10,544,484. The capital expenditure for the year was £62,505, and was principally for new plant and mains in connection with the London, Brighton and South Coast Railway Co.'s contract for the supply of power for working the trains on their South London line, which will be commenced next year. Special plant has been installed and mains laid to meet and anticipate the growing demand for power for industrial purposes. The plant and machinery have been maintained out of revenue, and are in efficient condition. The old contract with the London County Council for supplying power to the Council's tramways terminated in June last. The new contract runs to June, 1909, and the benefit thereof will shortly accrue. The power supplied for industrial purposes shows 50 per cent. increase. The directors have joined with the other electric supply companies in London in depositing a Bill in the coming session for conferring further powers upon all the companies, in order to obviate the necessity for, and to take the place of, the various Power Bills which have been promoted during the last two sessions. Such a Bill would utilise the existing plant, and meet the public demand for centralised power. To meet the growing business the directors recommend the creation of 20,000 more preference shares of £5 each. The opportunity will be taken to bring the articles of association up to date in accordance with the legislation passed since they were registered in 1887. Resolutions will be proposed at the meeting on the 21st inst. to that effect.

he hoped that they might be able in the future to obtain a still further reduction in their assessment.

Mr. G. H. Robertson seconded the motion, which, after some discussion, was adopted.

National Telephone Co., Ltd.

The directors' report for the half-year ended December 31st, 1906, to be submitted to the meeting on Thursday, February 21st, states that the income accrued in respect of the business of the half-year amounts to £1,241,843, as compared with £1,125,978 for the corresponding period of 1905, being an increase of £115,865. The working expenses for the half-year amount to £710,492, as compared with £647,847 for the corresponding period of 1905, being an increase of £62,646. The net result for the half-year (after deducting the Post Office Royalties amounting to £118,500) is a profit balance of £412,851, as compared with £372,265 for the corresponding period of 1905, being an increase of £40,586. The rentals carried forward for unexpired terms of running contracts amount to £1,057,806, compared with £972,500 for the corresponding period of 1905, being an increase of £85,306. Out of the available balance of £317,189 shown by the net revenue account, the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 5½ per cent. per annum on the deferred stock and new shares, less income-tax in all cases. The board also propose to transfer £135,000 to the reserve fund, and to carry forward the balance of £9,842. The sum of £521,263 has been expended on capital account during the half-year in the erection of 21,113 additional exchange and private stations, and in the construction of underground works. In their report for the half-year ending December 31st, 1905, the directors referred to the suggestion of establishing a fund from the revenues of the company for providing compensation for the limited number of officers who will not be taken over by the Postmaster-General upon the transfer of the company's undertaking to him after December 31st, 1911, and for the compensation of others who will suffer by the transfer, and the proposal met with the unanimous approval of the meeting. The board has accordingly had prepared a deed of trust for accomplishing this object, a copy of which may be seen by any proprietor at the secretary's office, and such deed will be submitted to the forthcoming meeting for approval. It enables the board to provide compensation for officers not taken over by the Postmaster-General, or who may have to render special services in relation to the transfer, and also for directors and others who may sustain loss of office by the transfer, or who, in like manner, may be called upon to render special services in relation to it. The board have learned with deep regret of the death, on January 14th last, of their valued colleague, the Right Hon. Sir James Fergusson, as a result of the earthquake in the Island of Jamaica, and they desire to express their high appreciation of the services which Sir James rendered during the ten years he was a director of this company. Sir James T. Woodhouse has resigned his position as a director upon his appointment to an important judicial office, and the board gratefully records its warm acknowledgment of the services rendered by him to the company.

The following are the results of the last four complete years' working:—

National Telephone Co., Ltd.

Year ending Dec. 31st.	Income accrued in respect of the business of the year.	Less Post Office Royalties.	Net income.	Working expenses.	Net result for the year.	Percentage of working expenses to net income.	Amount from previous year.	Debenture and other interest.	Preference and other dividends.	Carried to reserve fund.	Carried forward.	Rentals carried forward for unexpired terms.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£	£ s. d.	£ s. d.
1903..	1,835,843 3 4	168,248 16 9	1,667,594 6 7	1,036,698 5 0	630,896 1 7	62·16	12,451 0 6	140,008 12 10	297,833 6 8	195,000	10,505 2 7	827,163 19 10
1904..	2,018,979 16 7	185,937 6 9	1,833,042 9 10	1,154,695 18 9	678,346 11 1	62·99	10,505 2 7	165,877 4 4	297,833 6 8	215,000	10,141 2 8	889,577 14 1
1905..	2,212,358 18 5	206,455 7 5	2,005,903 11 0	1,275,161 1 11	730,742 9 1	63·57	10,141 2 8	196,858 5 9	299,166 13 4	235,000	9,858 12 8	972,500 3 7
1906..	2,436,994 13 1	231,847 18 9	2,205,146 14 4	1,402,230 3 7	802,916 10 9	63·59	9,858 12 8	212,961 9 11	334,971 7 6	255,000	9,842 6 0	1,057,806 6 5

Liverpool Overhead Railway Co.

The half-yearly general meeting was held on February 12th, Mr. Richard Hobson, deputy-chairman, presiding, in the absence of Sir William Forwood.

The Chairman, in moving the adoption of the report (see Electrical Review, Feb. 8th, p. 236), said there had been a slight increase in the financial result of the half-year's working. Personally, he could have wished that this had occurred in the direction of the number of passengers carried, for in the number of travellers on the line there was a deficiency of 84,119 as compared with the corresponding period of last year. The receipts were £415 less. There was, however, a favourable feature about their position, and that was that the percentage had increased. They had had recommendations from time to time to reduce the charges upon the railway, and the directors had always been anxious to attend to the views of the shareholders wherever they were compatible with the interests of the company. They had tried various experiments, but always with the same result—they took less money and did not get any more passengers. The benefit derived during the past half-year arose from the reduction of expenses of £1,966, and the net balance of the half-year's working showed £1,637 more than last year. One of the causes of the diminution of expenses was in regard to their coal consumption, and another reason was that they had saved £400 in rates. That saving was most satisfactory, and

Great Northern, Piccadilly and Brompton Railway Co.

The directors' report for the half-year ending December 31st, 1906, submitted to the half-yearly general meeting held at Hamilton House, yesterday, says that the capital expenditure during the half-year amounted to £844,013. The work of construction made such good progress during the past half-year that the directors thought it desirable that the railway should be opened for public traffic before the completion of the stations at South Kensington (now completed and in use), Down Street (Mayfair), and Covent Garden. An arrangement was accordingly made with the contractors, the Underground Electric Railways Co. of London, Ltd., which enabled the railway to be opened before it was handed over by the contractors. By this arrangement, the contractors take all receipts and bear all payments from the day of opening up to December 31st, they paying the guaranteed dividend at the rate of 4 per cent. per annum on the debenture and share capital for the same period. The railway was opened for public traffic on Saturday, December 15th, 1906, by the President of the Board of Trade. A very frequent train service is being run, and every effort is being made to bring to the notice of the public the new facilities for rapid travel across London which the railway affords. The receipts are increasing steadily, and the directors have every reason to believe that the proprietors will see during the current half-year a con-

tinuous development of the traffic of the undertaking. Through bookings are in operation with the District, the Baker Street and Waterloo, and the Great Northern Railways, and with the London United Tramways. The tunnels on the branch line from Holborn to the Strand have been constructed, and good progress is being made with the permanent way, cables and electrical equipment. The amount payable up to December 31st, 1906, by the Underground Electric Railways Co. of London, Ltd., under the terms of the agreement for lease, dated January 13th, 1903, permits of a dividend at the rate of 4 per cent. per annum, and a resolution declaring a dividend will be submitted to the meeting.

St. James's and Pall Mall Electric Light Co., Ltd.

This company's meeting was held on Tuesday, at Carnaby Street, Col. Eustace Balfour presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, February 8th, page 235), said the most conspicuous item in the accounts upon which they would naturally look for some explanation was the reduction in the amount of the net revenue available for dividend. They would remember that at the last meeting the chairman called attention to several circumstances which had then affected the revenue, viz., the large amount of rebuilding that had been proceeding in the district, the heavy charges for Parliamentary and law expenses, and the general fall in the price obtained for the sale of electricity. All those difficulties had remained with them during the past year. Some of the large rebuilding operations had not yet advanced quite enough to restore to them the important revenue of which they were deprived by the demolitions. The Parliamentary costs had exceeded those of 1905, and the fall in the price of electricity had continued, their average receipt having been 3·21d. per unit as compared with an average of 3·42d. in 1905. That considerable reduction in prices had been forced upon them by circumstances which operated generally throughout London, but causes peculiar to themselves had appeared to counteract to some extent the growth in output which should normally have compensated them for the loss in price. The actual loss of ·21d. per unit on their whole output meant a loss of no less than £7,200 in revenue, and their increased output of 300,000 units had brought them back only £4,000, leaving them some £3,200 to the bad. Some small savings in cost and increases in sundry revenue had reduced that deficiency to £2,500, but the desire of the Central Co.—in which they concurred—to reduce the cost per unit before paying a dividend, meant a loss of another £2,500, the two together making a loss of £5,000. The dividend was 2½ per cent. less than last year, £1,000 of which they had taken from the contingency fund. While the fall in the price received for their electricity must be looked upon as permanent, the circumstances which during the last two or three years had stood in the way of the company's expansion were only temporary, and he was glad to say that already there were signs of a return to a normal condition of things. The increase in their connections during the year was equivalent to 732·8 kw., as compared with 230·24 kw. in 1905, and the increase was still going on. The revenue for last month, January, exceeded that of January, 1906, by 10 per cent, and the directors were in a more hopeful frame of mind than they were in 12 months ago. The reduction in the price for power and heating to the flat rate of 1d. had enabled them to push that branch of the business. The use of electric radiators for heating at that low price was not only efficient and clean, but cheap. They had also further increased the use of electric power by adopting a system by which they placed motors in customers' premises at a reasonable charge for rent and maintenance. It was proposed to extend that system to other apparatus, and the result of their efforts in that direction was certainly promising, although he must say they had not found any evidence as far as their district was concerned to support the too sanguine estimates of the demand for power supply in London on which the large schemes before Parliament were based, although the rate at which they were offering to supply was actually below that proposed by either the L.C.C. or the Administrative County Bills. He might also call attention to the increasing use of high efficiency metallic filament lamps. While that at first involved a certain loss of output, they looked to it as one of the most important means of cheapening and popularising electric light, and they were confident that any temporary loss due to that would be quickly made good by the new field of business which would be opened up thereby. The amount of electricity purchased from the Central Co. had considerably increased—their engineers having satisfied themselves after long experiment that a material saving would be effected by their drawing the bulk of their supply from the more modern works of the Central Co. The number of units purchased would therefore continue to increase in the future, and there would be a corresponding decrease in the cost per unit. Now that the experimental stage of the Central Co. was over, it was expected that regular dividends would be received from that source in the future. Regarding the law expenses, they would be aware that the Bill which was promoted by their company and other West End companies was shelved by Parliament—the whole question of the supply to London being argued on the Bill promoted by the L.C.C. The fight was long and costly, and unfortunately it was to be renewed this year. The scheme of the L.C.C. was estimated to cost, including the purchase of all the companies and the municipal undertakings, a figure which might reach anything from 20 to 30 millions. To meet that formidable proposal the London companies had combined to promote a Bill asking for power to do what was at present forbidden—viz., to combine whether by way of amalgamation or of joint committee. They were prepared to show that if this power were given them they could supply London at as cheap a rate as that offered by the L.C.C. without any risk to the public funds, simply by combining and organising the existing sources of supply.

Mr. W. Leaf seconded the motion, and the report was adopted.

A Brown-Boveri Loan.—The present time has been selected by the directors of Brown, Boveri & Co., of Mannheim, which is a German subsidiary of the Swiss firm of Brown, Boveri and Co., of Baden, for the issue of a 4½ per cent. loan amounting to £225,000, which sum is intended to be devoted to the extension of the company's works and the settlement of floating liabilities. The price of issue has been fixed at 100½ per cent., and the redemption of the loan is to commence in 1912 and be completed by annual drawings at par up to 1936, but the right is reserved of increasing the repayments or of full redemption at any time as from 1917. It is provided that until this operation has been finished the company shall not issue a further loan which would confer greater rights than those incidental to the present emission, which does not have any mortgage guarantee on the company's property. These conditions are similar to those obtaining in the case of the loans issued by most of the electrical companies in Germany. At present the company has a share capital of £300,000 which is fully paid, and the dividend was at the rate of 6 per cent. in 1905-6, 5 per cent. in 1904-5, and 4 per cent. in each of the three preceding years when the share capital was £150,000. The company employs 1,740 workers, and the greater portion of the ordinary share capital is held by the parent firm in Switzerland.

City of London Electric Lighting Co., Ltd.—Subject to audit, the board has resolved to transfer £45,500 to reserve, and to recommend dividends at the rate of 6 per cent. on the preference, and at the rate of 6 per cent. on the ordinary shares for the past year, carrying forward £20,000. For the previous year the ordinary dividend was at the same rate, £45,500 was placed to reserve, and £22,000 was carried forward.

National Electric Supply Co., Ltd.—The directors have paid dividends of 4 per cent. for the year on the preference shares, and 4½ per cent. on the ordinary shares for the half-year, making, with the interim dividend paid in July, 7½ per cent. for the year, and £1 7s. 2d. on the founders' shares.

Oxford Electric Co., Ltd.—Subject to final audit, the directors have recommended a dividend of 7 per cent. on the ordinary share capital for the year ending December 31st, 1906, free of income-tax, including the interim dividend of 2½ per cent. paid in September last; and a dividend on the preference share capital at the rate of 5 per cent. from the date from which it ranks. Last year the ordinary dividend was the same.

Simplex Conduits, Ltd.—The first annual ordinary general meeting was held last week at the offices, Garrison Lane, Birmingham, Mr. Henry Huggins presiding. In moving the adoption of the report, he stated that the directors considered the result of the year's trading to be satisfactory. The profit for the year, after providing for bad and doubtful debts, amounted, with interest on investments and transfer fees, to £13,245, and after charging directors' fees, depreciation and income-tax, £2,080, and interest on purchase money, £884, there remained for disposal £10,281, which was appropriated as follows:—The preference dividend paid January 1st, 1907, absorbed £1,336; the whole of the preliminary expenses, amounting to £2,066, have been written off; and after paying a 10 per cent. dividend on the ordinary shares, free of income-tax, amounting to £4,000, and placing to the reserve fund £1,500, a balance of £1,380 is carried forward. The resolutions for the adoption of the report and payment of dividends were unanimously carried, and votes of thanks were accorded to the directors and staff.

Bahia Tramway, Light and Power Co.—A meeting of the holders of the 5 per cent. gold debentures of the company was held recently to consider resolutions authorising the issue of further debentures not exceeding $4,000,000, to extend and develop the company's system, and assenting to certain modifications and additions to the trust deed of November 20th, 1905. The resolutions, which also provided for the redeeming of the bonds at 103, instead of at par, and at the end of 50 years, instead of 40, were carried.

North Metropolitan Electric Power Supply Co.—A meeting of this company was called for Friday last. A representative of the Electrical Review attended to report the proceedings, but was informed by an official of the company that the meeting was private. Questions by our representative as to whether it was the annual meeting or a special meeting, or whether a copy of the report was available, were met with a stolid "Don't know."

Prospectus.—*The Inambari Para Rubber Estates, Ltd.*—The list was to close on Friday last in an issue of 200,000 shares of £1 each in this company, which is to acquire and work properties situate on the Inambari River, in the province of Carabayi, Peru.

British Electric Traction Co., Ltd.—The dividend on the 6 per cent cumulative preference shares for the half-year to February 15th has been declared.

Notting Hill Electric Lighting Co.—The directors recommend a final dividend of 4½ per cent. on the ordinary and preference shares for the year 1906, making 7½ per cent. for the year, and a dividend of £3 10s. per share on the founders' shares. Last year the dividends were 7½ per cent. and £3 respectively.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Route miles open. *
Aberdeen	Feb. 6	2,253	— 57	35	51,631	+ 1,765	14·4	..
Ayr	,, 2	313	— 39	38	11,689	+ 47	8	..
Bath	,, 9	1,115	— 85	6	3,639	— 177	13	..
Belfast	,, 8	6,157	+ 342	..	..	..	40	+ 6½
Birkenhead	,, 10	1,817	— 92	45	47,372	+ 763	13·62	..
Birmingham	,, 2	9,982	..	44	74,849	..	..	..
Blackburn	,, 6	1,679	+ 50	45½	46,641	+ 2,849	13·6	..
Blackpool Corp. ..	,, 7	600	— 16	43	50,816	+ 3,605	11·87	..
.. —Fleetw'd	,, 9	397	..	5	1,062	+ 40	8·25	..
Bolton	,, 10	3,668	+ 356	45	95,507	+ 7,602	26	+ 1
Bournemouth ..	,, 6	2,225	— 278	44½	73,358	+ 9,870	21·5	+ 2½
Bradford	,, 9	7,749	— 48	45	202,402	+ 7,209	53	+ ·7
Brighton	,, 10	1,253	— 169	45	43,600	..	9·5	..
Bristol	,, 8	8,713	— 336	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 1	411	— 9	4	977	— 31	3·65	..
Barnsley	,, 1	277	— 52	,,	641	— 28	..	..
Barrow	,, 1	394	— 4	,,	903	+ 15	5·87	..
Cavehill	,, 1	80	+ 28	,,	506	+ 70	..	..
Devonport	,, 1	788	— 21	,,	1,952	+ 45	8·85	..
Gateshead	,, 1	1,757	— 45	,,	4,165	+ 2	11·25	..
Gravesend	,, 1	360	— 26	,,	870	— 28	6·5	..
Greenock	,, 1	1,070	— 19	,,	2,442	— 110	7·25	..
Hartlepool	,, 1	432	— 93	,,	1,004	— 151	6·72	..
Kidderminster ..	,, 1	168	— 18	,,	372	— 40	..	..
Leamington	,, 1	233	— 11	,,	570	— 34	3	..
Merthyr	,, 1	349	+ 8	,,	811	+ 38	2·9	..
‡Metropolitan	,, 1	6,546	+1,056	,,	16,006	+ 3,428	22	..
Middleton	,, 1	519	— 48	,,	1,221	— 45	8·5	..
Mid. Joint Com'tee	,, 1	11,801	..	,,	25,779	..	..	..
Oldham — Ashton	,, 1	1,023	+ 1	,,	2,394	+ 106	9·13	..
Peterborough ..	,, 1	175	— 13	,,	411	— 33	5·31	..
Potteries	,, 1	3,392	— 111	,,	7,865	— 10	29	..
Rothesay	,, 1	78	— 11	,,	212	— 9	2·75	..
Southport	,, 1	365	— 100	,,	875	— 160	8·17	..
S. Metropolitan ..	,, 1	1,068	..	,,	2,799	..	..	..
Swansea	,, 1	1,426	+ 21	,,	3,413	+ 160	5·5	..
Tynemouth	,, 1	258	— 69	,,	687	— 102	3·75	..
Weston-s-Mare ..	Jan. 31	52	— 2	,,	107	— 9	3	..
‡Worcester	Feb. 1	410	— 48	,,	1,015	— 89	5·75	..
Wrexham	,, 1	159	— 37	,,	383	— 27	..	..
Yorks. Wool. Dist.	,, 1	1,586	— 109	,,	3,804	+ 90	17	..
Miscellaneous ..	,, 1	328	— 21	,,	772	— 53	..	..
Burnley	,, 9	2,120	+ 8	..	..	..	7·5	..
Burton-on-Trent ..	,, 10	494	..	45	12,781	— 510	10	+ 1
Bury	,, 3	1,613	..	44	42,799	..	10·5	..
†Cardiff	Jan. 26	1,748	— 49	43	39,488	+ 1,263	15·87	..
Carlisle	Feb. 9	260	— 54	6	881	— 137	..	..
Chatham and Dist.	,, 7	1,113	— 38	6	3,252	— 55	12·84	+ 3·5
Cork	,, 7	780	— 36	6	2,185	— 140	9·89	..
Croydon	,, 8	2,158	— 85	36	51,581	+ 4,017	12	+ ·75
Darlington	,, 9	573	— 1	45	9,435	+ 278	4·27	..
Darwen	,, 8	496	..	45	11,424	+ 477	4·26	..
Dover	,, 2	310	— 38	44	11,036	+ 1,102	4·75	..
Dublin	,, 8	8,915	— 144	6	25,480	— 94	51·25	+ ·5
Dundee	,, 6	1,935	— 19	36	41,989	+ 6,199	13	+ ·5
East Ham	,, 9	1,496	— 32	45	40,217	+ 2,186	8	..
Exeter	,, 8	429	+ 13	45	13,167	+ 481	4·75	+ ·5
Glasgow	,, 9	31,059	+1,306	38	612,160	+49,878	86·75	+11
Hastings	,, 8	1,265	..	..	..	..	..	..
Huddersfield	,, 9	2,165	+ 49	45	67,981	+ 5,655	28	..
Hull	,, 9	4,723	+ 253	45	104,908	+ 4,298	13	..
†Ilford	,, 9	280	+ 8	45	21,333	+ 828	6·37	..
Ilkeston	,, 6	250	+ 1	45	5,981	+ 623	3·5	..
Ipswich	,, 9	583	— 30	45	18,998	— 120	10·5	..
Isle of Thanet ..	,, 9	376	— 48	6	1,247	— 110	11	..
Kilmarnock	,, 9	292	+ 14	39	6,218	+ 104	4·25	..
Lan'kshire Trm. Co.	,, 7	1 879	+ 243	6	5,176	+ 271	15·8	+ 3½
Lancashire United	,, 6	1,958	+ 421	6	5,353	+ 1,201	37	+ 9
Leeds	,, 2	11,203	+ 64	42	275,561	+16,183	96	+ 6·5
Leicester	,, 9	3,957	— 11	..	..	..	..	..
Leith	,, 2	881	+ 2	26	19,479	+ 5,842	6	..
Liverpool	,, 2	19,833	— 300	5	49,523	+ 821	104	..
‡L.C.C.	Jan. 26	50,623	+25,666	43	1,126,352	+494,58	114	+63
London United ..	Feb. 8	9,478	+ 400	5½	27,4·8	+ 1,437	..	..
Lowestoft	,, 9	251	+ 22	19	3,010	+ 294	3·5	..
Manchester	,, 9	25,625	+1,193	45	620,212	+43,683	146	+21
Newcastle	,, 9	7 652	+ 257	45	182,270	+11,612	25·5	..
Newport	,, 9	1,085	+ 17	45	28,262	+ 1,805	14·5	..
Northampton	,, 8	679	— 36	44	19,509	+ 405	5·5	..
Oldham	,, 10	3,352	+ 418	46	82,300	+ 7,358	28·75	..
†Pontypridd	,, 2	151	+ 11	44	7,338	+ 564	3·5	..
Portsmouth	,, 9	2,581	— 250	45	87,895	+ 387	14·5	..
Preston	,, 6	1,211	+ 63	..	..	..	10	..
Reading	Jan. 24	1,045	— 72	43	27,107	+ 403	7·5	..
†Rochdale	,, 19	958	+ 122	..	..	..	20·6	..
Rotherham	Feb. 7	969	+ 103	45	22,718	+ 2,212	10	+ ·66
Salford	,, 4	7,812	— 219	44	197,714	+ 6,060	38·9	..
Sheffield	,, 12	10,143	+ 629	46	244,228	+17,025	35·75	+ 1½
Southampton	,, 6	1,502	— 151	44	42,915	+ 32	..	..
Southend-on-Sea ..	,, 6	416	— 50	45	17,600	+ 951	6	..
Sunderland	,, 11	2,430	+ 65	45	62,854	+ 3,248	10·87	..
Swindon	,, 6	252	..	..	..	..	4·4	..
Tyneside	,, 6	716	+ 46	6	1,885	+ 103	8·87	..
†Walthamstow ..	Jan. 19	401	+ 54	42	24,423	..	9	..
West Ham	Feb. 7	3,911	+ 42	45	101.054	+18,834	14·7	..
Wolverhampton ..	,, 6	1,420	— 11	44	37,657	+ 1,556	19·5	..
Yorks. W. Riding ..	,, 10	1,888	+ 503	6	5,785	..	..	..
Baker St.-Waterloo ..	,, 9	4,785	..	6	14,231	..	3·75	..
Cen. London Rly. ..	,, 9	12,832	—1,065	6	38,572	— 3,200	6	..
City & S. Lon. Rly. ..	,, 10	6,285	+ 257	6	18,738	+ 501	6·25	..
Dublin-Lucan Rly. ..	,, 8	168	— 9	6	488	— 23	7	..
G.N. and City Rly. ..	,, 9	3,822	+ 88	6	11,503	+ 113	3·5	..
G.N., P'dy. & Bromp.	,, 9	7,465	..	6	21,659	..	9	..
L'pool Overh'd Rly.	,, 10	2,644	— 89	6	8,179	— 192	6·8	..
Mersey Railway ..	,, 9	3,623	+ 140	6	10,969	+ 433	4·5	..
Metropolitan Rly. ..	,, 10	29,665	—3,485	6	99,594	— 9,415	70·5	..
Met. District Rly. ..	,, 10	15,757	— 413	6	47,444	— 1,546	24	..
Anglo-Argentine ..	,, 11	28,518	— 786	6	90,857	+ 2,671	48	..
§Auckland	,, 1	10,478	+ 696	4½	12,218	+ 254	19·24	+ ·6
§Brisbane	Jan.	12,465	+1,449	..	..	..	..	..
§Brit. Columbia Rly.	Nov.	20,084	+5,941	22	101,268	+18,188	..	..
†Bu'n's A'r's E.T.Co.	Jan. 12	3,409	+ 409	2	3,409	+ 409	24	..
Bu'n's A'r's-Blgr'no	Feb. 3	7,246	+ 476	5½	18,115	+ 1,139	..	..
Calcutta	Feb. 9	7,125	+1,377	..	..	..	..	..
§Cape Electric T. Ld.	Nov.	14,896	..	..	..	..	..	..
§Geneva	Dec.	7,206	..	..	..	..	..	..
§Kalgoorlie, W.A. ..	Jan.	3,777	..	4	3,777	..	20·5	..
Madras	Jan. 31	1,175	— 232	4	2,825	— 27	12·75	+3·5
§Lisbon	Nov.	5,583	..	..	..	..	..	..
§Mexico	Sep.	4,400	..	..	..	..	..	..
Perth (W.A.) ..	Feb. 8	3,004	— 294	6	9,031	— 148	25·6	..

* Compared with the corresponding period of 1905. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

No good thing for the electrical supply industry is expected to arise from the labours of the new Parliamentary session. In fact, Westminster is regarded rather in the light of an enemy to this particular market. Just as the home railway department looks with grave suspicion at the possibility of Parliament giving to Labour what few privileges Capital has hitherto considered were left to itself in the way of fixing hours of labour and rates of pay.

Ten falls and one advance are the net upshot of the week's work in the supply section. From the reports which have recently appeared, it is abundantly evident that the companies are not doing well. The "big" shares are nearly all affected with weakness. Falls have occurred in St. James's, Metropolitans, Westminsters, Chelseas and Notting Hills. Both the Edmundson issues are lower. Smithfield Markets Ordinary fell to 30s. upon the issue of an irritating report, which said that no dividend could be paid for "certain reasons" to be disclosed at the meeting this week. Why could not the directors make a clean breast of it in advance? No doubt they will give a satisfactory explanation to the meeting. We understand that the "certain reasons" have reference to the debenture-holders' insistence upon a fund being maintained that can be utilised for their benefit if by any mischance the company should be unable to get a renewal of its order for supply. City of London Preference are the only shares to show a rise, the price now standing at 12 middle. Prior-charge stocks have kept fairly firm, and show only a couple of small falls.

Central London stocks have been, and still are, very flat, the Deferred shedding no less than 4 points. This brought the price down to 65½, included in which was the dividend of £4, making it 61½ *ex* dividend. At this the yield is not far short of 7 per cent. on the money, the highest yield obtainable from any Home Railway stock. Even if the dividend were reduced to 3 per cent. twelve months hence, the return would still work out to 5 per cent. on the investment. That the directors are alive to the situation is seen in the statement that they have under consideration a scheme for reorganisation of the fares, whereby the uniform twopence would give place to a graduated scale. If this happened, the very serious point would arise of whether the "Twopenny Tube" could conscientiously retain its pet nickname.

Great Northern and City shares are 3½, and did not alter upon the chairman's statement as to the ratio of expenses to receipts. The contractors' guarantee of interest runs out this year, after which, of course, nobody can tell what will happen to the dividend. City and South London has not altered.

Telegraph issues are little changed: there is that much to be said in their favour. The feature, however, is a severe shake-out of the bulls of Anglo-American Deferred, which caused the price to slump to 23½, a drop of 3½; it has been as low as 22. The Ordinary stock at 67 shows a two-point loss, and the Preferred is 1½ easier. The drop was brought about by realisation on the part of weak holders, possibly the earlier advance had been a trifle too rapid. Cuba Telegraphs are ⅛ lower, West India and Panama 1/16 better, and Marconi's 1/16 lower. There is not another change worth soiling clean paper to mention.

Telephone descriptions are almost motionless. Business in them has been very retail, but National Telephone First and Second Preference rose 10s. upon the excellent nature of the report.

Traction issues have a few rises deserving of record. The Anglo-Argentine shares are good, and Belgranos continue to be most favoured. The Ordinary shares at 4 3/16 are 1/16 higher. British Electric Traction Ordinary remain dull at 3⅞, and the Preference at 7½ are lower. British Columbia Electric Railway stocks have advanced, three of them having rises of a point each. None of the London stocks show any change, but Underground Electric Profit Notes are another 1 per cent. to the good at 84. Metropolitans are 48½, and Districts 16½.

Henley's shares are better upon a little investment demand, the Ordinary going to 12. India-Rubbers, on the other hand, weakened to 15½, Edison & Swan "A" shares to 1⅜, and British Aluminium to 5⅝, the latter on account of the recent new issue. Crompton Preference rose to 2⅛ and the Debenture stock to 96½, but the manufacturing, like the supply section, is quite unexciting, although it is decidedly firmer as regards prices. The Mexican Light and Power publishes a satisfactory report, upon the strength of which the shares rose to 57, while the bonds are 87½ middle.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer register for ordinary and 7 per cent. cumulative preference shares will be closed from 15th to 28th inst., both days inclusive, for the preparation of warrants for payment of dividend.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Feb. 5th.	Closing Quotations Feb. 12th.	Business done week ended Feb. 12th, 1907. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 – 3½	3 – 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,360 Red.	100	Nil	Nil	5 %	5 %	88 – 91	88 – 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	6¼	6¼	6¼	6¼	68½ – 70½	66 – 68	68	67½	– 2½	5 14 0
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	6¼ %	6 %	6 %	112 – 113	111 – 112	112½	111½	– 1	5 7 2
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	4 %	1¾ %	26½ – 27½	23½ – 23¾	26⅛	22⅜	– 3⅛	7 7 4
50,000	Anglo-Portuguese Tel., 6 % Mort. Deb. Stock Red.	100	..	..	5 %	..	101 –103	101 –103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6¾ – 7¼	6¾ – 7¼	⅝	..	..	5 10 4
2,097,660	Commercial Cable Sing. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	96¼ – 98½	96¾ – 98¾	..	..	..	4 1 3
16,000	Cuba Telegraph	10	0 %	5 %	5 %	..	8¼ – 9	8⅜ – 8⅝	8¼	8⅛	– ⅛	5 14 0
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	..	17 – 18	17 – 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	8¾ – 8¾	8¾ – 8¾	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	9 – 9¼	9 – 9¼	9⅛	..	..	5 5 8
80,000	Do. do. 4½ % Debs.	20	4½ %	4½ %	4½ %	4½ %	98 –101	98 –101	..	..	..	4 9 1
80,7101	Direct United States Cable	20	8 %	8½ %	4½ %	..	15½ – 16	15½ – 16	15⅞	15⅜	..	5 6 3
67,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,500, R.	100	4½ %	4½ %	4½ %	4½ %	99 –101	99 –101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	137 –142	137 –142	141	138	..	4 18 7
2,000,000	Do. 8½ % Pref. Stock	100	8½ %	8½ %	8½ %	..	86 – 88	86 – 88	86⅞	86	..	8 19 7
1,596,765	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	..	106 –108	106 –108	107⅜	..	..	3 14 1
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½ – 14	13¾ – 14	13⅞	13⅝	..	5 0 0
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 –107 xd	105 –107	..	..	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 5,000, red. 1909	100	4 %	4 %	4 %	4 %	99 –101 xd	99 –101	..	..	..	3 19 3
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 –102	100 –102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5¼ %	5⅝ %	5½ %	..	10⅜ – 10⅝ xd	10⅜ – 10⅞	10⅜	10⅜	..	5 2 4
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	14 – 14½ xd	14 – 14½	14⅛	14	..	4 2 9
160,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24 %	..	37½ – 39½	37½ – 39½	..	..	..	6 6 6
33,400	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½ %	4½ %	4½ %	4½ %	99 –101	99 –101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	..	58 – 60	58 – 60	..	..	..	5 8 4
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	¾ – 1	¾ – 1	18/1½	16/10½	– 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord. ..	1	8 %	4 %	5 %	..	1 – 1½	1 – 1½	21/3	20/-	..	4 8 11
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	32/- – 1 3/32	33/- – 1 3/32	..	..	..	4 16 5
2 225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 - 111	109 –111	110½	109½	..	5 8 1
2,225 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½ %	110½ 112½	110½–112½	111½	110½	..	4 17 9
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11 – 13	11½ – 13½	13	..	+ ½	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 – 12	10½ – 12½	..	..	+ ½	4 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝ – 7/8	5⅝ – 5⅞	5⅞	5⅝	..	4 5 1
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½ %	3½ %	3½ %	3½ %	97 – 99	97 – 99	97½	..	..	3 10 8
1,689,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 –102	100 –102	102	101½	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½ %	6½ %	7½ %	..	1⅝ – 1⅞	1⅝ – 1⅞	2/7/9	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1⅜ – 1⅝	1⅜ – 1⅝	26/3	..	..	4 11 5
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	96½ – 98½	96½ – 18½	..	..	..	4 1 3
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	100 –102	99 –102	..	..	– ½	3 18 5
11,882	Reuter's	8	5 %	5 %	5 %	..	7½ – 8	7½ – 8	7⅞	..	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½ %	4½%	99 –102	99 –102	..	..	..	4 8 3
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	126 –129	126 –129	126⅜	..	..	4 13 0
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅜ – 7½	6⅜ – 7½	6⅞	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛ – 5⅜	5⅛ – 5⅜	..	..	..	4 11 11
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 –112	109 –112	..	..	..	4 9 3
15,609‡	West African Telegraph, Shares	10	4 %	4½ %	4 %	..	10 – 10½	10 – 10½	..	..	..	3 16 2
30,008	W. Coast of America, 1 to 80,000 & 88,001 to 88,008	2½	Nil	Nil	Nil	..	3/32 – 1/16	3/32 – 1/16	18/-	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 –102	99 –102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13½ – 14½	13⅝ – 14½	14	13⅞	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 –104	101 –104	..	..	..	3 16 11
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅛ – ¼	3/32 – 1/16	18/-	10/-	+ 1/16	Nil
34,568	Do. do. 6 % Cum. 1st Pref. ..	10	7 %*	6 %	5 %	..	7 – 7½	7 – 7½	..	..	..	6 13 4
4,869	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	5½ – 6½	5⅝ – 6½	5⅝	..	..	Nil
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 –102	99 –102	..	..	..	4 18 0

‡ Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	5	..	8 %	8 %	..	7⅞ – 8⅛	7⅞ – 8⅛	8 1/32	7⅞	..	4 18 6
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5⅛ %	5⅛ %	5⅛ %	5⅛ %	5⅞ – 6	5⅞ – 6⅛	6	5⅞	+ ⅛	4 9 10
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	125 –128	125 –128	127½	127	..	4 6 11
265,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 –107	104 –107	106⅜	106¼	..	4 13 6
830,000	Babcock & Wilcox, 1 to 830,000	1	17 %	20 %	20 %	..	3¾ – 4⅛	3¾ – 4⅛	81/6	80/-	..	4 14 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1 1/16 – 1 1/8	1 1/16 – 1 1/8	..	..	..	3 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	..	5 – 6	5½ – 6	6 5/16	6 1/32	– ⅛	5 16 8
40,000	Do. do. 7 % Cum. Pref...	5	Nil	7 %	7 %	..	6¼ – 6⅝	6¼ – 6⅝	6⅛	6⅛	..	5 8 8
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5 – 5½ xd	5 – 5½xd	..	..	..	5 4 4
90,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 – 4½	4 – 4½	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 –105	101 –105	..	..	..	4 15 3
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 –101 xd	98 –101 xd	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	..	130 –135	131 –136	134⅜	133	+ 1	4 8 3
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	..	113 –117	114 –118	116½	115½	+ 1	4 4 9
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 –110	107 –111	110	109½	+ 1	4 10 1
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½ %	4½ %	4½ %	4½ %	102 –105	102 –105	102	..	..	4 5 9
250,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½ %	4½ %	4½ %	4½ %	101 –104	101 –104	..	..	..	4 6 7
188,801	British Electric Traction	10	6 %	6 %	8 %	..	3⅜ – 4½	3¼ – 3⅜	77/6	65/-	– ⅛	8 5 6
161,427	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	7⅜ – 8¼	7¼ – 7⅞	7⅞	7 1/16	– ⅛	7 18 11
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	106 – 109	106 –109	106½	..	..	4 11 9
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½ %	4½ %	..	85 – 88	84 – 87	86½	84½	–1	5 3 6
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	..	6¾ – 7	6¾ – 7	6	..	..	5 14 3
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	5⅞ – 6 xd	5⅞ – 6 xd	..	..	..	5 0 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½ %	4½ %	4½ %	4½%	100 –103	100 –103	..	..	..	4 7 5
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½ %	4½ %	4½ %	..	94 – 98	94 – 98	..	..	..	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1⅜ – 1⅝	1⅜ – 1⅝	27/3	..	..	Nil
1,015,988	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	70 – 74	70 – 74	..	..	..	5 8 1
50,000	¶Brownell, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞ – 1	⅞ – 1	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	..	⅞ – 1 1/16	⅞ – 1 1/16	16/10½	..	..	4 15 3
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1½ – 2	1½ – 2	30/-	..	..	6 0 0
125,000‡	Do. 4½ % Perp. Deb. Stock ..	Stock	4½ %	4½ %	4½ %	4½ %	95 – 97	95 – 97	..	..	..	4 12 9
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	80 – 83	80 – 83	..	..	..	5 8 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	..	3⅝ – 4⅛	4 – 4⅛	8/1½	7/8/9	+ 1/16	3 8 7
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	..	5¼ – 5⅜	5¼ – 5⅜	5⅜	..	..	5 11 8
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	..	5 – 5½	5 – 5½	5⅜	..	..	5 14 3
13,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 –106	104 –106	..	..	..	4 14 4
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 –104	101 –104	..	..	..	4 16 2
105,000	Calcutta Trams., 1 to 105,000	5	6 %	8 %	8 %	..	8 – 8½	8 – 8½	8⅜	..	..	4 14 1
82,610	Do. 105,001 to 187,610	5	..	..	8 %	..	7⅞ – 8¼	7⅞ – 8¼	..	..	..	4 17 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5¼ – 5⅜	5¼ – 5⅜	..	..	..	4 6 11
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	103 –106	103 –106	..	..	..	4 4 11
35,000	Callender's Cable Construction shares	5	12½%	12½%	15%	..	9⅜ – 10⅛	9¼ – 10⅛	10⅜	9⅛	..	7 8 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅜ – 5⅝	5⅜ – 5⅝	5⅝	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 –108	106 –108	105½	..	..	4 3 4
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	1/16 – 1/8	1/16 – 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	..	1½ – 1⅝	1⅝ – 1⅞	39/6	..	..	5 1 1
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 –102 xd	97 –102 xd	97½	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	78 – 80	76 – 78	79½	76½	–2	5 2 7
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	96 – 98	96 – 98	97½	..	..	4 1 8
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	68 – 71	64 – 67	66½	64	–4	5 19 5
1,480,000	City and South London Railway	Stock	2¾	2½	1¾	2½	44 – 46 xd	44 – 46 xd	44½	44	..	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½	2½	2½	..	1⅞ – 2⅛	2 – 2¼	41/3	..	+ ⅛	3 6 8
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 – 97	95 – 98	..	..	+1	5 2 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Feb. 5th.	Closing Quotations Feb. 12th.	Business done week ended Feb. 12th, 1907.		Rise + or Fall—	Present Yield per cent.
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1⅞ — 1¹⅛	1⅞ — 1¹⅛	23/3	..	..	5 18 6
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	..	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	5 1 1
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6¾%	6 %	6 %	..	14 — 15	14 — 15	..	..	..	4 0 0
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	14 — 15	14 — 15	..	..	..	4 0 0
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	2½%	4½%	..	1⅝ — 1⅝	1½ — 1½	27/6	..	—⅛	9 5 0
17,199	Do. "A" shares, 01—017,199 ..	5	Nil	2½%	4½%	..	2¼ — 2¾	2¼ — 2¾	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	90 — 95	90 — 95	..	..	..	5 5 3
113,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	⅞ — 1	⅞ — 1	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	..	1½ — 2	1½ — 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 — 84	81 — 84	..	..	..	4 15 3
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8⅞ — 9⅛	8¾ — 9⅛	..	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
78,000	Gt. N. & City Rail Pref. Ord. "A" 4·% 1 to 78,000	10	8 %	4 %	4 %	7 %	8½ — 8¾ xd	8½ — 8¾	70/-	..	..	11 18 9
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼ — 10½	10¼ — 10½	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	104 —104	102 —103	..	..	— ½	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	..	11½ — 12¼	11½ — 12⅛	12	11⅛	+ ⅛	6 0 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5⅞ — 6	5⅞ — 5⅞	..	..	..	4 0 11
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	108⅜	..	..	4 2 7
60,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ — 16½	15½ — 16½	15½	..	— ½	6 3 1
87,500	†Liverpool Overhead Railway, Ord.	10	1⅜	1½	Nil	Nil	1½ — 1⅝	1½ — 1⅝	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid ..	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 2 10
600,070	London United Trams (1901), 1 to 50,007	10	8 %	6 %	8 %	..	7 — 8	7 — 8	..	..	..	8 15 6
899,980	Do. do. 60,008 to 100,000 (£8 paid) ..	10	8 %	6 %	8 %	..	5 — 5½	5 — 5½	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	8 — 9	8 — 9	..	..	..	5 11 1
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	89 — 91	88 — 91	89	88½	..	4 7 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	..	3/32 — 7/32	3/32 — 7/32	3/-	..	..	Nil
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	6 — 1 xd	6 — 1	18/9	18/-	..	5 0 0
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	96 — 99	96 — 99	97½	97½	..	4 10 11
30,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	6 10 8
24,500	Potteries E. Tro., 20,001 to 40,000 & 50,001 to 54,500	10	5 %	5 %	4 %	..	6 — 7	6 — 7	..	..	..	5 14 4
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	5 %	5 %	5 %	..	7 — 8	7 — 8	..	..	..	6 5 0
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	98½—101½	98½—101½	..	..	..	4 8 8
37,850	Telegraph Construction and Maintenance ..	12	20 %	15 %	15 %	15 %	31 — 33	31 — 33	32½	30½	..	5 8 7
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	..	5 %	5 %	5 %	82 — 84	83 — 85	..	..	+1	5 17 8
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1½ — 2	1½ — 2	30/-	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3¾ — 4	3¾ — 4	..	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 82	77 — 82	..	..	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5⅓%	5⅓%	..	5 — 5⅛	5 — 5⅛	..	..	..	5 0 0
77,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 11 1
10,502	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	7⅛ — 8	7⅛ — 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	8 17 8
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	8 %	..	8½ — 4½	3½ — 4½	..	..	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	..	..	..	5 12 6
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	97 —100	100	..	—1	4 0 0
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	5 — 5½	4½ — 5½	5	..	— ½	5 14 3
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	..	9¼ — 10¼	9¼ — 10¼	..	..	..	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	5 %	11½ — 12¼	11½ — 12¼	12½	..	+ ½	4 16 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	..	5 %	6 %	6 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
40,000	County of Durham Electrical Power, Ord.	4	4 %	£3 7 0	4 %	..	3½ — 4⅝	3½ — 4⅝	..	..	..	3 16 2
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	..	4⅜ — 5⅛	4⅜ — 4⅞	..	..	..	4 15 3
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	..	8½ — 9½	8½ — 9½	..	..	..	5 8 1
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10½ — 11⅛	10⅜ — 11⅛	..	..	..	5 4 4
400,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	105	..	..	4 3 4
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	2 — 2½	2 — 2½	42/6	..	— ⅛	8 17 9
80,000	Do. do. 6 % Cum. Pref... ..	5	6 %	6 %	6 %	..	4 — 4½	3⅞ — 4½	87/6	81/3	— ¼	7 1 2
360,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
10,000	Folkestone, 1 to 10,000	5	5⅓%	5⅓%	5⅓%	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 17 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 15 3
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100 xd	97 —100 xd	7⅞	..	..	4 19 0
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	..	7⅞ — 8	7⅞ — 8	..	..	..	5 12 6
21,000	Kensington and Knightsbridge Electric Ord. ..	5	12%	12 %	10 %	..	9¼ — 10¼	9¼ — 10¼	..	..	..	4 17 7
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100 xd	97 —100 xd	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	8	Nil	8 %	4 %	4 %	2 — 2½	2 — 2½	42/6	..	..	4 17 0
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	5⅛	..	..	3 14 3
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8⅜%	10 %	10 %	..	7 — 8	6⅞ — 7⅜	7⅛	..	— ⅛	6 9 0
76,121	Do. 4½ % Cum. Pref. 1—71,106 ..	5	4½%	4½%	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 3 9
230,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —110	106 —110	..	..	..	4 1 10
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	93 — 95	91 — 94	..	..	—1½	3 13 10
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	..	7⅞ — 8	7⅞ — 8	..	..	..	5 0 0
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	..	5⅝ — 6¼	5⅝ — 6¼	..	..	..	4 1 8
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	13 — 14	12¼ — 13¼	..	..	— ½	5 11 1
64,000	Do. do. 4 % 1st Mort.Deb... ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	..	6 — 6½	6 — 6¼	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	12½%	10 %	9 — 10	8½ — 9½	9⅛	8⅞	— ⅛	5 5 3
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..	4 7 6
150,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	93 — 95	93 — 95	..	..	..	3 13 8
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1½ — 2½	1 — 2	37/6	..	— ½	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	71 — 75 xd	71 — 75 xd	..	..	..	5 6 8
65,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	3 %	2⅞ — 3⅜	2½ — 3	55/7½	55/-	— ⅜	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord..	1	Nil	Nil	2½%	..	3/32 — 5/32	3/32 — 5/32	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref.... ..	1	7 %	7 %	7 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	2⅞ — 3⅜	2⅞ — 3⅜	60/-	..	..	6 13 4
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	3¾ — 4¼	3⅜ — 4¼	80/-	77/6	..	5 17 8
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
110,000	Westminster Electric Supply, Ord.	5	18½%	14 %	13 %	12 %	9½ — 10½	9½ — 10½	9⅛	9⅜	— ⅛	5 17 1
81,279	Do do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5½ — 5¾	5½ — 5¾	..	..	..	3 18 3
	(Originally 5%—Red. to 4½ % from 31st Dec., 1905.											

Shares not officially quoted:—Mackay Companies, ord., 75—77 +1. Pref. 71—73.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

Bank rate of discount 5 per cent. January 17th, 1907.

REVIEWS.

Practical Alternating Currents and Power Transmission. By Newton Harrison. New York: W. L. Hedenberg Publishing Co. 1906. Price $2.50.

On the title page we read that this is "a practical treatise on the principles and applications of alternating currents to central station and power house plants, including the elements of power transmission, enriched by 172 illustrations."

The author states in his preface that "the correct treatment of a subject like alternating currents has been regarded, with much truth, as being consistently mathematical on all occasions. The fact of the matter is, that however mathematical the treatment of the theory may seem to be, the practice is within the scope of any earnest reader's intelligence."

The book is written for the practical man, and mathematics have been eliminated as far as possible. Let not the mathematicians grieve, however, they will find plenty of inductance formulæ, eddy current loss formulæ, power factor formulæ, &c., in the book.

The book is admirably printed, the type is clear, and the diagrams are excellent. They "enrich" the work. The author's method of explaining phenomena is original, and it will be helpful to the beginner in many cases. We think, however (possibly because we are English), that his style is somewhat stilted and his meaning occasionally obscure. In his preface, for instance, he seems in the following to be hinting at his critics. "It must be understood, however, before this preface is closed, that a non-producing class exist, whose main work consists in the assumption of superior attitudes toward the earnest efforts of others, particularly when crystallised in book form." We recognise the "earnest effort" of the author, the care that he has taken to make his book "thorough," and his originality, but we do not consider the book to be the ideal one on the subject, although it will doubtless be a help to many. The main defect is a lack of lucidity and a very cramped literary style. For instance, after the definition of the effects of mutual inductance we read:—"It may be stated, therefore, without equivocation, that the actual development of power in the totally disassociated secondary is due to the direct effect of mutual induction." What this amounts to is "that the development of the power in the isolated secondary circuit is due to mutual induction."

The description of eddy current losses is good, but it is only correct when the effect of the eddy currents in screening off the interior of the iron sheets from the effects of the magnetising force is negligible. The dielectric strength of air is given as 30,000 volts (p. 161) but no mention is made of the shape of the terminals, and so the table given is of very little value. At the top of page 172 we cannot understand what the author means when he says that the customary "cycles" for single-phase alternators range from 120 to 266 per second. Assuming that this means a frequency varying from 60 to 133, it seems to us high even for America.

The notions of the author on inductance are much clearer than those usually found in engineering books. His formula for a solenoid, however, would be about 50 per cent. out in the case of the shorter coil shown on fig. 26, and 25 per cent. out in the case of the longer coil. The principle that the self-induction is proportional to the square of the turns is only true in very special cases. There are a few misprints in the formulæ on pp. 138 and 139 and on p. 209.

Elementary Experimental Electricity and Magnetism. By William Allanach. London: Longmans, Green & Co. 1906. Price 3s. 6d.

This book is intended to guide students in Day Secondary Schools and Evening Science Classes through a course of lectures and laboratory work. The author states that his endeavour has been to conform to Bacon's dictum, that "all true and fruitful natural philosophy hath a double scale or ladder, ascendant and descendant; ascending from experiments to the invention of causes, and descending from causes to the invention of new experiments." He avoids what he calls "fancy" experiments having a spurious semblance of accuracy, and describes only perfectly straightforward ones, the limitations of which can be readily grasped by the student.

The author has done his work well, and we recommend the book as a trustworthy guide eminently suited to help the class of student for whom it is intended. His meaning is always clear—except, perhaps, when he uses the word "heuristic" in the preface, as electrical engineers, unfortunately or fortunately, have no time to keep up their classical knowledge; the diagrams are good and carefully drawn, and the work is not blemished by misprints, which annoy the professional critic's eye and are too frequent in works of this nature.

The statement on page 214, that Joule found the mechanical equivalent of heat to be 42 million ergs per calorie, is slightly misleading, as the student would naturally think that the present day value was found by Joule. As a matter of fact, his final result was about 1 per cent. low. We should have preferred a more vigorous definition of capacity than the one given by the author. According to his definition, the capacity of a conductor depends on the position of other conductors in the neighbourhood. If we alter the position of these other conductors, we alter the "capacity of the conductor." The capacity, therefore, is not a fixed attribute of the conductor. This is not the mathematical definition of capacity, and students may have difficulty in understanding why the capacity of a sphere equals its radius. Again, in defining a condenser, there is no necessity to say that one of the two conductors is earthed. It was statements of this kind that gave us "furiously to think" in our young days. Perhaps this is why the author introduces it, as in his preface he commends "a little careful and honest thinking."

Motive Power and Gearing for Electrical Machinery. By E. Tremlett Carter, M.I.E.E. Revised by G. Thomas-Davies, A.M.I.E.E., F.R.S. London: The *Electrician* Printing and Publishing Co., Ltd. 1906. Price 12s. 6d. net.

The revision of this book for the present edition was unfortunately interrupted by the death of the author, and a considerable proportion has been rewritten or revised by Mr. G. Thomas-Davis. The work is intended to explain and solve in simple language the problems which are likely to assail the engineer in laying down motive power for the supply of electricity. Purely electrical considerations are not touched upon, the intention of the author, as stated in the preface, being to confine himself entirely to mechanical difficulties, and the means by which they may be overcome.

The first chapter, which is headed "Fundamental Principles," deals mainly with the theoretical aspect of the subject.

"A Statement of the Problem" is the title of the second chapter, in which some indication is given of the factors governing the choice of a site upon which to generate electricity, and the most economical type of motive power both as regards the work to be done, and the available means of doing it.

The value of different solid fuels is next thoroughly thrashed out, and the theory of combustion is fully gone into.

To the student and steam engine designer every page of chapters 4 and 5, on Thermo-dynamic Principles and Steam, contains useful matter clearly and concisely set forth, a study of which is absolutely necessary if these subjects are to be properly understood.

In chapter 6 relating to "Furnaces and Boilers" all the different types to be met with in electricity works are fully described, the special features appertaining to each different design being carefully set out. The remainder of this chapter deals with boiler trials (of which many instances are given) thermal balance sheets for boilers, steam and feed pipe systems and superheaters.

Furnaces and boilers may be said to have been exhaustively treated with the following exceptions:—Only the live steam method of producing forced draught is described, no mention being made of the use of fans for obtaining air pressure in the ashpits or a partial vacuum in the flues. Chain grates

are ignored in dealing with mechanical stoking. Boiler feed pumps driven by electric motors are barely touched upon, and no particulars are given of the necessary steam traps for draining the piping. In view of up-to-date practice in these matters the above points should have received some attention.

In chapter 7, which deals with "The Theory and Action of the Steam Engine," this part of the subject is very clearly explained, and those interested in the efficiency of the steam engine will do well to study it carefully. One point, however, does not appear to have received the attention its importance demands; this is the effect of clearance space on steam consumption.

Two chapters are devoted to "Steam Engine Details," and to the description of typical steam engines, including turbines as well as the Ferranti engine. The design of the latter must always be of great interest, as being almost ideal as regards theoretical perfection, and fully justifies its mention in this treatise. It was unfortunate that its manufacture was stopped almost immediately after complete success had been attained.

"Steam Engine Testing" is dealt with, and methods of obtaining steam consumption and horse-power are fully considered. The "heat-flow" diagram designed by the Steam Engine Research Committee of the Institution of Mechanical Engineers is not mentioned, an omission which should certainly be made good in any future editions of this work.

The effect of superheating is studied, and comparative curves of heat and steam consumption are illustrated for saturated and superheated steam; also a table is given showing particulars of tests upon various engines for which superheaters have been provided. The results are compared in the form of heat units per KW.-hour, which is the only fair basis for comparison where superheating is resorted to.

In the chapter which treats of "The Steam Engine in Relation to Electric Power," load factors are first explained and considered. The comparative effects of throttle and auto-expansion governing are carefully gone into, and results from actual practice are illustrated by curves. Types of boiler are discussed, and tables are given showing the floor space taken up, and the proportions of various types of plant in use in 1904.

Plant capacity, size of units, &c., with a table showing the progressive increase of load and capacity in several well-known electric supply stations, are next touched upon; the loads of traction stations are discussed in relation to the number of cars in use, and curves are given to illustrate the rules laid down.

A short chapter on "Gaseous and Liquid Fuels" practically completes the portion of the book relating to steam as a motive-power.

The following six chapters relate to gas engines and producers. This portion of the book, excepting as regards the theoretical data, cannot be considered as up-to-date, but it has been supplemented by Mr. Thomas-Davies in an appendix.

The theory of hydraulics is well set forth in the following part, and many useful formulæ and tables are given. Turbines and Pelton wheels are considered, many different types being illustrated and the details explained. Water-power testing is dealt with, and in the final pages devoted to water, turbines are considered in "Relation of Electric Power."

Part V is relegated to the study of gearing. The horse-powers given which can be transmitted per sq. in. section of solid leather belts at 1,000 ft. per minute with various coefficients of friction are not at all in accordance with present-day practice, in which the increasing speeds and powers developed by electric motors have demanded heavier loading of the belts or the adoption of abnormally large pulleys. Taking the coefficient of friction at ·27, as decided by Prof. Capper after the Lille experiments, and an arc of 180° embraced by the belt, 1 sq. in. of belt area is stated to transmit about 3·4 H.P. at 1,000 ft. per minute; on this basis 1 in. in width of single leather belting $\frac{3}{16}$ thick, would only carry ·65 H.P. at the same speed, or one H.P. at 1,440 ft. per minute. A perusal of the pulley sizes of any well-known maker of motors will show that 1 H.P. is frequently transmitted by 1 in. of single belt at 600 ft. per minute, and the same width of double belt is sometimes called upon to carry a horse-power at 250 ft. per minute. It is not intended to indicate that the belts actually run at this speed; taking the latter figure as an example, if 100 H.P. were to be transmitted at 2,500 ft. per minute, a 10-in. belt would be required.

No mention is made of the rounding of pulley faces, a point which should have been treated to make this part of the book complete. Rope driving is very thoroughly gone into.

The strength of shafting is considered, and useful formulæ are given for obtaining the correct size to transmit power at stated speeds. Flanged couplings are also touched upon, and the application of clutches is described and illustrated.

Spur gearing is exhaustively dealt with excepting for the omission of rawhide gear, which can certainly claim some attention in view of the extent to which it has been adopted for motor driving. Worm gear is very briefly touched upon.

Chapter XXX describes and illustrates a number of well-known steam power stations, of which very full details are given, and gas and water-power stations are similarly dealt with in the last chapter of the book.

In the appendices thermal storage is explained, and the omissions complained of in regard to the chapters on gas and oil engines are very fully gone into and the most recent practice is described.

Every page of this book is useful both to the student and to the commercial engineer, and with the exception of the one or two minor points mentioned above, the ground has been thoroughly gone over, entitling this work to a prominent place amongst the classics of mechanical engineering.

THE STANDARD SPECIFICATION FOR CARBON GLOW LAMPS: A CRITICISM.

By LANCELOT W. WILD.

After more than a year of incubation, the standard glow lamp specification has at length been hatched. Under these circumstances, a criticism from one who has not only been accustomed to draw up glow lamp specifications, but has also been constantly engaged in the more difficult task of seeing that they are carried out, will, I hope, not be taken amiss.

Clause 8 provides that the lamp caps shall be tested for insulation resistance at the manufacturer's works. The insulation resistance required is 1,000 megohms between the filament and cap.

I frequently find that lamp caps have a very low insulation resistance initially, if tested quickly and at a low voltage. The leakage, however, very quickly disappears if the test is prolonged, and the higher the voltage, the quicker the change. I have frequently found the insulation of caps to go from 0 to infinity, when tested with an Evershed ohmmeter, in less than 10 seconds. It appears to me, therefore, that the voltage and duration of the test should have been specified.

Clause 9 provides that the test for vacuum shall be the vacuum test employed at the works of the manufacturer. This means, I take it, that the manufacturer can make any test he likes and translate the result how he likes. It would appear that the Committee have been unable to arrive at any standard method of measuring vacuum. Under these circumstances, I think that it would have been better if the matter of vacuum had been omitted from the specification.

Clause 10 provides that 5 per cent. of the total bulk of lamps shall be tested for rating. The lamps are to be tested for mean horizontal candle-power, watts and inefficiency. Ninety per cent. of the selected lamps are required to fall between certain limits of candle-power, consumption and inefficiency. As the measurement of light value is to be given in terms of mean horizontal candle-power, instead of mean spherical candle-power, which is the only true measure of the total light emitted, it follows that filaments of different form will be in reality differently rated.

As regards the limits proposed, they are reasonable enough,

so long as the manufacturer can find a market elsewhere for his outfalls. If, however, the specification were to become universal, either the manufacturer would have to scrap about half his lamps, or else, which is perhaps possible, he might find a way of making his lamps come out to the voltage intended, thus doing away with the present method of sorting. If this should be the result, the specification would prove a real blessing.

Clause 11 provides that 5 per cent. (never less than five lamps) shall undergo a species of life test. The lamps are to be run on a pressure not varying more than ½ per cent. This appears to be reasonable enough, although it would be better still if it could be found practicable to narrow this limit still further.

The lamps selected are to be run not at their marked voltage, but to start at some standard inefficiency. This is an ideal condition if the object of the test is to ascertain the quality of the filament, quite apart from its rating. The advantage gained by running at standard inefficiency is, however, more than neutralised by the fact that the test is terminated, not when the candle-power has dropped to 80 per cent. of its original value, but when the candle-power has dropped to 80 per cent. of its standard value. Thus a lamp starting at 16 C.P. may drop to 80 per cent. of this, whereas a lamp starting at 16·5 C.P. is allowed a much larger drop of candle-power, although both lamps are started at the same inefficiency. Now the lamp is judged by the so-called useful life, and the average candle-power hours obtained during this life. At the point of cut-off, that is, when the candle-power has dropped to about 80 per cent., the slope of the candle-power life curve is commonly such that a change of life of 10 per cent. is accompanied by a change of candle-power of about 1½ per cent. If, therefore, a lamp starts at 1½ per cent. above its standard candle-power, the useful life as specified is extended by about 10 per cent., and likewise the lamp that starts 1½ per cent. low in candle-power is robbed of 10 per cent. of its life. Moreover, an error of 1½ per cent. in the last candle-power measurement also makes a difference of 10 per cent. plus or minus to the life of the lamp. As 10 per cent. variation of life is all that is permitted by the specification, it follows that the passing or rejecting of a large batch of lamps will depend quite as much upon the judgment of the testing authority in selecting the lamps to be tested, and also upon the accuracy of the final measurements of candle-power, as upon the merits of the lamp filaments.

This, however, is not the worst point about these life tests. There is an even larger source of error brought in by the fact that the lamps are judged by their mean horizontal candle-power, rather than by their mean spherical or true candle-power.

The reduction factor or ratio of mean spherical to mean horizontal candle-power varies in lamps of different manufacture from ·8 to ·9. These are extreme limits, I admit, but I have found them actually occur fairly frequently.

Now, suppose we have two high-voltage lamps, each giving 16 mean horizontal candle-power and each consuming 3·7 watts per mean horizontal candle-power. Let one of these lamps have a reduction factor of ·8 and the other ·9, then their mean spherical candle-powers will be 12·8 and 14·4 respectively, and their true inefficiencies 4·63 and 4·12 watts per candle-power respectively. Now supposing that the filaments of both lamps are of absolutely the same quality, then the useful life—that is, the time taken to fall to 80 per cent. of its original candle-power, will be very different for the two lamps. The lamp with a reduction factor of ·8 will probably live from two to three times as long as that with a reduction factor of ·9. This circumstance appears to me to make the life test quite valueless.

Now I hold that it is not fair to criticise others' proposals unless one has something which appears better to suggest oneself. As a basis for a life test specification I would suggest the following :—

The lamps selected for life test to be run for, say, 500 hours, and to be tested for mean spherical candle-power at start, and after 100, 200, 300, 400, and 500 hours. These results to be averaged together. The average candle-power of all lamps tested throughout the 500 hours not to be lower than a certain limit. The average watts and inefficiency should also fall below and above certain limits respectively. Any lamp failing in vacuum during the run to be omitted from the tests. As the final values obtained are the averages of many separate measurements, the personal error in making the measurements is eliminated.

It is open to question whether the lamps should be started on test at their marked voltage or standard inefficiency. The latter is the better plan if the object is to determine the quality of the filament only. This, however, is likely to be misunderstood, and I think that if the lamps are selected so that their average starting inefficiency is standard and the individual variations at start are not great, carrying out the test at marked voltage will be found the more satisfactory, besides being very much more convenient. It must be remembered that, other things being equal, the lamps which start with the highest inefficiency will finish with the lowest, and thus the average will be maintained fairly well.

Now, as regards the determination of mean spherical candle-power: some years ago, this would have meant half a day's work on each lamp; there are, however, several short cuts to this, and I will give four methods.

One way to obtain mean spherical candle-power is to measure the mean horizontal candle-power and multiply by a factor, which however must be first determined for the particular make of lamp.

A method that I should prefer is to measure the maximum horizontal candle-power, this involving two measurements, taken on opposite sides of the lamp. This should be multiplied by a factor which is practically independent of the shape of the filament. This factor varies only from ·805 to ·825 in lamps of all makes.

A third method is to employ an integrating photometer, giving the mean spherical candle-power in a single measurement.

A fourth method is to rotate the lamp on its axis and arrange for tilting it whilst rotating it. This gives the result desired in six measurements.

PROCEEDINGS OF INSTITUTIONS.

Alloys of Aluminium and Copper.

Prof. H. C. H. Carpenter and Mr. C. A. Edwards have made a report on this group to the Alloys Research Committee of the Institution of Mechanical Engineers, which was read at the meeting of January 18th. The work, of which the results are given in this report, was carried out at the National Physical Laboratory. It is a survey of the mechanical properties of the whole series of these binary alloys. No survey of even the smallest tract of country can ever be really exhaustive, and a survey, complete only within very restricted limits, usually involves a great deal of work. This particular survey is no exception to that rule, and the number of measurements and comparisons recorded in the report is very large indeed. It is designed to form the foundation of further research on ternary alloys of copper, aluminium, and some third constituents, and is the necessary sound preliminary to steps in that direction. The alloys examined are grouped by the authors in three classes:—

Class 1.—Alloys rich in copper. In this section 16 different alloys were examined containing from 1 per cent. to 13 per cent. of aluminium.

Class 2.—Intermediate alloys. This section contained 32 alloys, containing from 15 per cent. to 90 per cent. of aluminium.

Class 3.—Alloys rich in aluminium. In this section are 16 alloys, with from 0 to 8 per cent. of copper.

Generally speaking, each alloy was examined as cast in sand, as cast in a chill, and as rolled. Information is given in the paper on methods of casting and contraction; on specific gravities; on tensile strength, hardness, torsion, alternating stress, and impact tests; on electrical conductivity; on liability to corrosion; on heating and cooling curves; and on micro-structure. The heating and cooling curves, of which the data are very numerous, become so complex with the increase of aluminium that they are difficult to interpret. Of the three classes the first proved the most interesting, and the experiments on its alloys were the most complete. The materials used were the purest obtainable, and the impurities discovered by analysis were exceedingly small. None could be detected by analysis in the cathode copper used, and the microscope showed no trace of oxide. In the aluminium 99·54 per cent. and 99·7 per cent. was the metal. The most interesting results from the engineering point of view of this series are those of the well-known aluminium bronze containing 10 per cent. aluminium.

The alloys of Class 2 have little interest, as they are all brittle. From 20 per cent. to 65 per cent. they are exceedingly so, and can be pounded in a mortar, so that unless for bronze powders or paints they seem to have no value.

The alloys of Class 3 in which small quantities of copper are added to aluminium offer no very striking results. The tensile strength of aluminium, both at the yield point and at the ultimate limit, can be improved from two to three times by addition of 3 per cent. to 4 per cent. of copper; and cold-drawn rods of one alloy containing 3·76 per cent. Cu gave a yield point stress of 18·5 tons. Having a specific gravity of only 2·79, this alloy seems possibly suitable for overhead transmission lines, but the elongation beyond the elastic limit to the breaking point is only 7·5 per cent., and no information is given as to the conductivity. These alloys containing little copper were found to resist corrosion by fresh water, but were freely acted on by salt water. The alloys, on the other hand, rich in copper resist the action of salt water perfectly.

To return to aluminium bronze, that alloy of Class 1 containing 10 per cent. of aluminium, we quote two passages from the report, one being a table of the results of the tensile tests, and the other a comparison between the properties of this alloy and those of a moderately high carbon steel.

Alloy No. 13 (*Aluminium* 9·90 *per cent.*)

Condition.	Yield point. Tons per sq. in.	Ultimate stress. Tons per sq. in.	Elongation on 2 in. Per cent.	Reduction of area. Per cent.
Sand casting	11·3	31·70	21·7	—
Sand casting, slowly cooled from 800° C. (1,472° F.)	13·3	Not obtainable. The bar broke in the head.		
Sand casting, quenched from 800° C.	22·4	50·00	3·0	—
Chill casting	12·4	36·93	30·5	—
Chill casting, slowly cooled from 800° C.	16·5	26·40	5·0	—
Chill casting, quenched from 800° C.	17·7	38·57	22·0	—
Rolled bar, 1¼ in. dia. ...	13·6	35·03	31·5	30·52
Rolled bar, 1 1/16 in. dia. ...	14·8	38·10	28·8	30·80
Rolled bar, 1 1/16 in. dia. slowly cooled from 800° C.	15·7	28·51	6·5	10·20
Rolled bar, 1 1/16 in. dia. quenched from 805° C. ...	26·2	45·48	11·0	16·78
Cold-drawn bar 1 1/16 in. dia.	40·4	43·94	13·0	22·19

A Comparison of the Properties of Alloy No. 13 *with those of Swedish Bessemer Steel of about* 0·35 *per cent. of Carbon.*—The research described in Part 2 has brought out a fact of very remarkable interest, namely, *that the qualities, both mechanical and physical, of Alloy No.* 13 *resemble those of a Swedish Bessemer Steel of about* 0·35 *per cent. of carbon to a truly astonishing degree.* When it is remembered that the former is an alloy of copper and aluminium, the latter an alloy principally of iron, carbon and manganese, the parallelism of qualities appears especially interesting. It is, however, a matter of surprise that the resemblance between two well-known alloys—for No. 13 is the so-called aluminium bronze or aluminium gold—has not hitherto, so far as the authors are aware, been adequately described.

(A) *Similarity of Mechanical Properties.* (Rolled Materials).
Tension Test.

—	Yield-point. Tons per sq. in.	Ultimate stress. Tons per sq. in.	Elastic ratio.	Elongation on 2 in. Per cent.
	§			
Steel (0·35 % carbon)	15·2	38·0	0·40	26·0
Alloy No. 13	14·8	38·1	0·39	28·8

§ This is the true, not the primitive, yield-point.

Although no figures are available for an exact comparison of the quenched alloys, there is an undoubted resemblance between the two. The tenacity is raised and the ductility lowered.

Alternating Stress Test.

Maximum limit of resistance for one million reversals at 800 per minute, with a ratio of tension to compression of 1·4.

Steel (0·35 C.)	29·5
No. 13	28·3

Impact Test. (Izod Machine.)

Foot-lb. absorbed on fracture (without deformation).

Steel (0·35 C.)	4·3
No. 13	4·5

(B) *Similarity of Physical Properties. Hardness and Hardening Capacity Tests.*

—	Hardness numbers.		Hardening capacity.
	Annealed.	Quenched in water at 20° C. (68° F.).	
Steel (0·35 % of carbon)	156	402	2·58
No. 13	210	349	1·66

The similarity is probably closer than the above table represents. The hardness number (210) of No. 13 is that of the unannealed alloy. A lower value would probably be obtained for the annealed alloy. Thus the hardening capacity figure would be raised and brought nearer the steel.

From the last extract we have omitted a passage comparing the microstructures of the Cu—Al alloy and the steel. There are curiously close analogies between the two, but for these and for the numerous micro-photographs illustrating them the original paper should be consulted. Here is an alloy cast in sand as easily as brass, and capable, we suppose, from experience of casting copper, of giving sound castings of a fairly intricate kind. The metal as cast in sand has an ultimate stress of 32 tons, when quenched from 800° C. of 50 tons, with which we may compare gun-metal 23 tons, manganese bronze 28-32 tons, phosphor bronze 15-26 tons. No figure is given of the hardness of the quenched sand casting, but considering its small elongation, 3 per cent., and its high ultimate stress, 50 tons, it is presumably much harder than the rolled bar of the same alloy, which has an elongation of about 30 per cent., and an ultimate stress of about 35 tons. The figure of hardness of the latter, Brinell's test, is 210, the hardest steel known having a figure 800. Quenched steel of ·66 per cent. carbon has a figure much below 600. To be able to produce complicated pieces, such, for instance, as the clutches, gears, and brakes of motor-cars, in a very hard and stiff material with a high elastic limit, in sand castings, may be of great value to many industries. For the construction of new or experimental machinery, the cost of delays incidental to procuring malleable or steel castings or special forgings will often justify the use of the more costly materials. For hydraulic and submarine work, such an alloy, incorrodible by sea water, even when bolted to steel plates, may be of great value.

A very curious and interesting discussion of the fact that the crystals of the microstructure grow in size with repeated melting, will be found in this report. It is suggested that the individuality, and even the systematic structure of these crystals, is not lost in the liquid state, but that it may persist through repeated remelting and resolidification, with increase in size of the individual crystals. A reference to recent discoveries of crystalline liquids, and soft or gelatinous crystals, gives the source of this suggestion.

Electricity in Mines.

On January 25th a paper on this subject was read by Mr. E. G. L. Mosley before the Institution of Electrical Engineers (Manchester Students' Section). The author said that mining engineers were beginning to realise the manifold advantages which accrued from the use of electricity for mining operations of all descriptions. Great care in manufacture was essential, as breakdowns might mean stoppage of a whole mine, or jeopardise men's lives. The advantages claimed for electricity were cleanliness, safety, adaptability and efficiency. The best type of cables, he thought, were non-hygroscopic and those least subject to deterioration through gases and dampness. They should be protected from mechanical injury and falls of earth. If a mine was tolerably dry and free from gas, ordinary standard motors were suitable, provided they were protected by gauze or perforated metal to avoid mechanical injury, but in gassy mines it was absolutely essential that the motors should be flame-tight. They should be placed in well-ventilated compartments. By no means the least advantage of electric driving was the very great variation in speed which could be obtained. The ideal motor to drive pumps for sinking purposes was the three-phase motor with short-circuited rotor, provided the H.P. was not too large (say, not over 50 H.P.). High-lift turbine pumps coupled direct to a motor occupied a very small space, and did away with gearing. Hauling gears had been brought to a state of perfection. Capstans were also used for surface work, and were very useful where there was no locomotive, or where there was limited head room. Electrical energy was also used with success for ventilating, screening and conveying. The Home Office report for 1905 stated that electrical coal-cutters were being installed at a much greater rate than formerly, the increase being in excess of that of those driven by compressed air. Lamps should be enclosed in an air-tight glass case or water compartment, so that if a lamp were broken, the spark would be extinguished. The success or failure of an electrical installation for mines depended first of all on the class of plant installed; and secondly, on good supervision. In erecting an installation, the primary consideration should be to eliminate any risk of fire taking place through an electrical agency.

Large Gas Power Plants.

By C. E. Douglas, A.M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers *at Manchester, January* 22*nd*, 1907.)

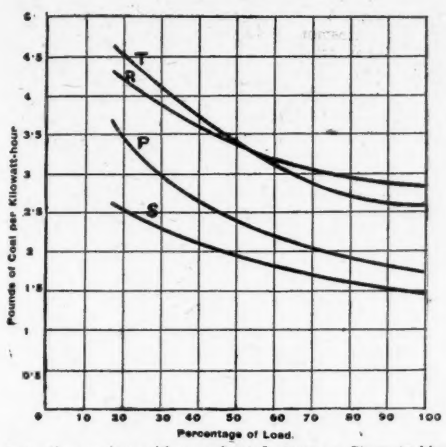
The three principal prime movers available in this country for powers of 200 brake H.P. and over are the reciprocating steam engine, the gas engine, and the steam turbine.

The ordinary industrial unit ranges from say 200 to 1,500 B.H.P., and it is with the suitability or otherwise of gas plant for such installations that I propose to deal.

The most weighty consideration is reliability, combined with low cost of operation. I wish to prove that for industrial purposes the gas engine, along with its supply plant, is at least sufficiently reliable to warrant a much extended sphere of operation, and that it can be operated with greater economy than any other form of power plant, at least, within the limits stated.

On the Continent of Europe, outside the British Isles, large gas engines aggregating literally hundreds of thousands of horse power are installed and in constant daily use. It is true that a large majority of them are working on waste gases from blast furnaces, but this is simply a matter of local conditions and convenience.

The value of the gas has nothing whatever to do with the satisfactory operation of the engine, provided of course that the value in any installation remains reasonably constant, that the engine is designed to suit the gas, and that the gas is suitably cleaned before



R, Reciprocating engines with superheated steam; T, Steam turbines with superheated steam; P, Gas engines with bituminous coal and "pressure" producers; S, Gas engines with "suction" producers. Units, 300—1,600 KW.

FIG. 1.—CURVES SHOWING COMPARATIVE COAL CONSUMPTION FOR DIFFERENT TYPES OF GENERATORS.

admission to the engine. There have been failures, in some cases serious failures, abroad as well as at home; but the cause will almost invariably be found in want of experience on the part of the builders, whose zeal has in such cases outrun their discretion and their knowledge of the conditions of the problems to be dealt with.

Turning to the question of economy of operation, it is not sufficient to consider merely the usual station or working costs; we must also take into account interest and depreciation on capital outlay, because in most cases of large gas power plant this is somewhat greater than the outlay involved by a new steam station of equal capacity.

Taking works costs alone, the items for wages, running stores, repairs and maintenance differ little in the two cases: on the other hand, even the most inveterate critic of the gas engine cannot deny its marked superiority as a heat engine over the steam engine. This means a substantial diminution of the heaviest item in works costs, *i.e.*, the fuel bill. There is a further saving in that the stand-by losses in the case of gas are really very much less than in the case of steam. A gas producer only requires about one-twentieth of the fuel that is necessary in the steam boiler for banking fires overnight or during periods of light load. Mr. Dowson has shown that on a 500-B.H.P. steam plant, the stand-by losses have been assessed at 15 per cent. of the total fuel consumed in 24 hours, while the stand-by losses in a gas plant of equal capacity only amounted to 2 per cent. of the total coal consumed. In the case of municipal stations with a relatively low load factor, this point is of the utmost importance. I frequently hear it stated that the heat efficiency of the gas engine on low loads is bad compared with the heat efficiency of the steam engine under similar loads. Fig. 1 shows the comparison between the two, the figures in each case being based on actual results and not on assumption. It will be seen that even at low loads, the fuel consumption of the gas plant is appreciably lower than that of the steam plant.

Diagram (fig. 2) shows that fuel alone amounts to half the total working costs with steam plant. It is precisely this item which can be so substantially reduced with gas plant.

As to capital cost, if a new steam station is to be installed on the most economical lines, the total cost of the installation, including buildings, foundations, and chimney, is not far short of the cost of installing gas plant. It is not necessary to provide a house for the gas producing and cleaning plant.

Whether the coal be anthracitic or bituminous (provided that, if the latter, it be a non-caking variety) there are now many excellent producers which will efficiently gasify and cleanse such coal. Caking or coking coal is inadmissible, because it forms a sticky mass which chokes the producer. Coke is also, in many cases, applicable for producer purposes. Anthracite is an ideal fuel to use; but except in cases where it can be obtained in reasonable proximity to the site of the plant, its cost generally precludes its use, except for small plant.

The higher the price of coal, the greater the saving to be effected by gas. In one works near London, the proprietors of a mill burned anthracite, costing about 20s. per ton, under their boilers, in order to prevent smoke nuisance in a densely-populated district; my firm installed a gas engine of 500 B.H.P. to replace their steam engine, and a producer plant to gasify bituminous coal was put in. In this case, in addition to, let us say, at least halving the amount of coal formerly used by the steam plant, the price of the coal per ton was practically halved as well, so that the original fuel bill is now reduced by about 75 per cent.

The water consumption of gas is much below that of steam plant; taking irrecoverable water alone—*i.e.*, that used for raising steam—in the first place to generate gas, and in the second, to supply steam engines; about 1½ lb. of steam are required per H.P.-hour with gas engines, while we can safely take 15 lb. of steam per H.P.-hour as being required for condensing steam engines. Mr. Hugh Campbell has stated that, for suction gas installations, the total quantity of water required, both for raising steam and purifying gas, is from 1½ to 2 gallons per B.H.P.-hour. In addition to the water for the producer, water is required for the engine jackets. Let us allow that 12 to 15 gallons per B.H.P.-hour is sufficient for all engine and producer purposes. In the case of condensing steam plant, 52·5 gallons are required as against a maximum of 15 gallons for the gas plant, and taking the irrecoverable water as well, we get a ratio of 54 to 15. In the case of steam turbines requiring a high degree of vacuum, the proportion will generally be much higher. If the water supply be unfit for use in boilers without purification, it is clear that the gas plant scores still higher. With regard to the works cost, the gas plant and engine do not involve any more skill or more attendants than steam plant, especially when all auxiliaries are taken into account. The producer requires no more skill than a boiler, and an unskilled man or ordinary attendant can as easily run a gas engine as a steam one. Provided the lubricating arrangements are well carried out and a minimum amount of oil is applied at proper points, there is no cause to fear a heavier consumption than with steam engines.

The suction producer is certainly by far the cheapest to install. The pressure producer for bituminous coal is more expensive on account of the large proportion of volatile hydrocarbon which is distilled from the coal as tar, and must be removed if the engine is to run satisfactorily.

In the plant designed by Mr. Wilson, of Stafford, atmospheric cooling, and consequent cleaning, of the gas is resorted to, with the result that a dry cold tar-free gas is supplied to the engine. This is a better method than cooling and washing the gas by spraying with water, because the drier the gas is fed to the engine the better.

As to regularity of turning moment, the difficulties have generally been overcome. I have watched double-acting two-cycle gas engines coupled direct to and driving three-phase 50-cycle alternators in parallel with perfect synchronism, and have actual knowledge of other similar gas engine sets running in parallel with each other and with steam-driven alternators.

At the works of Messrs. Rowntree & Co., Ltd., of York, two engines are installed capable together of giving 500 E.H.P. continuously at the switchboard. The calorific value of the bituminous coal used during three recent tests each of 12 hours duration averaged 12,250 B.T.U. per lb., and the gas varied between 140 and

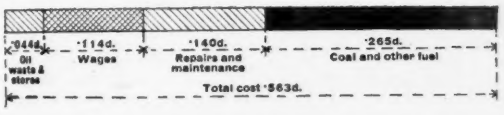


FIG. 2.—AVERAGE WORKS COSTS OF 10 GENERATING STATIONS WITH RECIPROCATING STEAM ENGINES (LIGHTING LOADS).

152 B.TH.U. by analysis. The fuel consumption in the producer averaged 1·3 lb. per KW.-hour, a most remarkable result. The engines have run for many weeks continuously, with rare stoppages, from 7.30 a.m. on Monday, till noon on Saturday, and operate in parallel with steam-driven sets situated in another engine room. The engineer to the company states that the cost per KW.-hour works out distinctly cheaper than if produced on the high-speed steam plant, in spite of the fact that the capital charges per unit on the gas plant are distinctly higher than they will be when it is brought up to its full capacity of 1,000 E H.P.

In another case, where a 500-B.H.P. gas plant replaced a steam plant of equal capacity, the saving is one-third of 1d. per B.H.P.-hour, which, at 10 hours a day and 300 days a year, is equivalent to about £2,000, notwithstanding the fact that a greater amount is allowed for depreciation on the gas engines than was allowed for the steam.

In a plant installed by my firm, the total generating costs work out, on three months' ordinary running, at 0·135d. per unit, probably the lowest actual working costs on record. The load is certainly steady and continuous; but even if you double or treble this figure to contrast the running of this plant with one having the load-factor of an average Corporation station, you get a generating cost much below that of any steam station, having units within the limits of size which we have been discussing.

DISCUSSION.

Dr. HOPKINSON (who presided) thought the author had been hardly fair to British manufacturers. In Germany the majority used blast furnace gas, whereas in this country they used producer gas, and there was far more difficulty in using producer gas, on account of the presence of tar. Probably the greatest loss that occurred in the gas engine was in the exhaust. It was possible to store about one-half the heat by installing a large boiler.

Mr. SEATON said the author seemed to think he was fairly safe from steam turbine competition below 1,500 KW. units, but personally, whenever turbines were in competition with gas engines, he had no difficulty in securing the adoption of the turbine for

powers of 500 KW. It was a difficult matter to obtain any information on the point of reliability, as users of gas engines seemed to think that, by saying nothing at all about them, they were doing the makers a great favour.

Mr. C. D. TAITE said the paper contained a table giving coal consumption, which averaged 0·265d. per unit; but if a modern station were taken as an example, it was possible to show a figure of 0·10d. per unit, a very different figure. Capital charges in an electric station were much bigger than running charges, and varied from 1d. to 1½d. per unit, depending on the load factor, and this had a greater effect on the selling price than the cost of fuel. That, he thougnt, was the reason why the gas engine had not found favour in this country. Having recently to get out the cost of a station of 6,000 KW. capacity, he was favoured by a tender from an important firm of gas engine makers for a complete station, which compared with steam turbines as follows, viz.:—

Type of engines.	Cost.	Running charges KW.-hour.	Fuel KW.-hour.	Load factor.
Gas	£110,000	0·374d.	0·06d.	28·5
Steam turbine ...	£84,000	0·379d.	0·107d.	28·5

The figures given for gas engines included all necessary plant, also an ammonia extractor. The difference in capital cost in favour of steam turbines was 30 per cent. If the figures were taken for a smaller station or a less load factor, they would show much worse against the gas engine.

Mr. PORTER knew of at least six firms in Germany using twin tandem gas engines of about 2,000 B.H.P. which were running satisfactorily.

Mr. COOPER remarked that the curve of coal consumption at full load showed steam engines at 3 lb. per KW. hr. as against 1·5 lb. for gas engines. Taking coal at 10s. per ton and anthracite at 27s. per ton there was not much saving in favour of gas engines. Reference was made in the paper to water consumption, but the water used in steam engines with surface condensers was practically all recoverable.

Mr. JOHN CLAY (Chairman of the Hebden Bridge U.D.C. Electricity Committee) said that at Hebden Bridge they found that Scotch anthracite was a more difficult coal to work with, but more economical. Welsh anthracite gave the same results and worked out to about 0·25d. per unit generated. As to the question of tar, he thought that it would eventually be possible to break it up and gasify it. Then they could use the ordinary Lancashire and Yorkshire coal costing from 8s. to 10s. per ton, which would reduce the cost of fuel 50 per cent. They found that producer gas was more satisfactory to work with than town gas.

Mr. J. FRITH said that if the gas were measured in an engine room at a temperature of 50° the cubic foot might have expanded to something like 1·04. That was a point often lost sight of.

Mr. DOUGLAS, in reply, said he was as much interested in one form of power as another. On the question of reliability, he could show gas engines that had been working night and day for long periods without giving any trouble. There had been failures, but they were getting fewer every day. It was not necessary to pay 25s. to 27s. per ton for coal, as ordinary coal at about 10s. per ton was quite good enough, and was used for both steam and gas plant. Chemists were divided in opinion as to whether it was possible to split up the hydro-carbon gas. He agreed with Mr. Frith as to measuring the gas at standard temperature and pressure.

The Faraday Society.

OSMOTIC PRESSURE.

THE feature of the last meeting of the Faraday Society, held on January 29th, which was attended by a crowded audience, and presided over by Prof. H. E. Armstrong, F.R.S., was a symposium, opened by the Earl of Berkeley, and followed by Mr. W. C. D. Whelham, F.R.S., Dr. J. M. Lowry, Prof. Kahlenberg, Mr. H. H. Morse, Dr. J. C. Philip, Mr. J. Rhodin, Dr. A. Findlay and Mr. W. A. Davis, on the difficult and highly-contentious subject of osmotic pressure. We say highly-contentious, because although by the expenditure of much knowledge, ingenuity, and mechanical skill, careful experimenters, such as the Earl of Berkeley, who opened the discussion, and Mr. Hartley, of England, and Morse and Frazer, of America, have succeeded in measuring *something*, which something more or less agrees with figures deduced theoretically, it is still open to question as to what actually is the pressure that is being measured, or whether, indeed, any pressure truly osmotic really exists at all.

A brief consideration of the fundamental experiment of osmotics will soon make the position clear. Imagine a porous membrane—which can be approximately obtained in the real—which will allow pure water to pass through it, but, protectionist-like, objects to the passage, say, of dissolved sugar through it. Fill this membrane, let it be a pot, with a solution of sugar, close up its ends, and immerse it in pure water. It is found that more water will now want to enter the pot from outside, and if an outlet in the form of a vertical gauge be provided, water actually will enter, driving the sugar solution up the gauge until a certain head of liquid exercises a back pressure sufficiently great to stop the inward flow. The equilibrium pressure is what is known as the osmotic pressure of the solution, and it varies with the concentration and with the temperature. The Earl of Berkeley's and Mr. Hartley's beautiful and elaborate apparatus is in reality a simple adaptation of the old porous pot experiment, except that instead of letting the solvent pass through the membrane and produce a head of liquid that causes equilibrium, he provides a mechanical pressure from a plunger worked with a pile of weights, and this pressure, transmitted first through oil, and then through a mercury U-tube, prevents all flow of solvent from the beginning. Equilibrium is obtained or calculated by watching through a telescope the solution to a gauge. Lord Berkeley also, for experimental reasons, reverses the usual arrangement by putting the solution *outside* the semi-permeable tube, in an outer containing tube of gun-metal, and the solvent *inside*, suitable mechanical arrangements being provided for rendering the joints leak-tight. He also applies various corrections which need not detain us here.

Many years ago Van't Hoff drew attention to the fact that if measurements for osmotic pressure be made at varying concentrations and various temperatures, the pressures so measured will follow very closely in the case of dilute solutions, the well-known law of gases $P v = R T$ (where v stands for the inverse of concentration), the constant R, strange to say, being the same in both cases. From this fact, the unjustifiable deduction was made that the conditions must be identical in the two cases, and that, for example, in dilute sugar solutions, the osmotic pressure was wholly due to the bombardment of the membrane by the molecules of the sugar. But as Mr. Rhodin justly remarked, in the course of the discussion, if this were the case, we should have the flow of liquid taking place from the area of lower to that of higher pressure. A more satisfactory explanation of the osmotic effects is that elaborated by Dr. Lowry, and which follows directly from ordinary kinetic theory. The mere presence on the surface of a solution of molecules (namely, the solute) which cannot enter the membrane, is alone sufficient to check the escape of some of the solvent particles themselves, which otherwise would diffuse freely and equally in both directions. This will cause, therefore, a flow of liquid to take place through the membrane into the solution, which can only be checked by putting pressure on the solution. Perhaps the most attractive feature of Dr. Lowry's theory is the ease with which it explains the relationship which is known to exist between osmotic pressure and the lowering of the vapour pressure of a liquid caused by the presence in it of a dissolved substance. For the free surface of solution is a perfect semi-permeable membrane, allowing molecules of the solvent to pass in either direction—from liquid to vapour or vapour to liquid—but preventing the non-volatile molecules of the solute from passing through. Hence while the rate of condensation of solvent will be unaffected by the presence of the solute, its rate of evaporation or escape will be reduced, and equilibrium will only be restored by decreasing the vapour pressure. The quantitative relation is easily deduced, and there is, as a rule, close agreement between the osmotic pressure as measured directly in an apparatus like Berkeley-Hartley's, and that calculated from vapour pressure measurements such as made by the improved method also devised, and described at the meeting, by the Earl of Berkeley and Mr. Hartley. As a matter of fact, this latter method is of such general applicability, since it can be used with any solvent, at all temperatures, and under all pressures, that it will chiefly have to be relied upon to furnish accurate data for the further study of osmotics.

It is gratifying for an English audience sometimes to be told that they are not, in scientific matters, ages behind the Germans, and that the example of the latter is by no means at present one that should be set up as a pattern to follow. Prof. Armstrong ascribes what he calls the dogmatic, unscientific treatment in physical chemistry now ruling in Germany, by which independence of thought is sacrificed to deference to authority—the "it must be so because Ostwald says it is" attitude—to the prevalence of the military spirit, which tends to crush individuality under the heels of discipline.

THE FIXATION OF ATMOSPHERIC NITROGEN AND THE UTILISATION OF THE PRODUCTS OBTAINED.

RECENT issues of the *E.T.Z.* contain an article by Dr. G. Erlwein to which the above title is given. The paper opens with a brief historical account of the early attempts made by various chemists and physicists to force the nitrogen of the atmosphere into some form of combination useful to vegetable or animal life. Dr. Erlwein quotes the names of Cavendish, Priestley, Werner von Siemens (whose dream it was to effect the synthesis of human food), A. W. von Hoffmann, Frölich, Sir W. Crookes, and Lord Rayleigh as early investigators, and then he proceeds to refer to the experimental processes worked out by Birkeland, Kowalsky, Pauling, von Lepel, Muthmann, Hofer, Nernst, Guye, Brode, and several others. After having sketched the nitric acid process devised by Bradley and Lovejoy, the somewhat similar Siemens process, and the Birkeland method, which have already been fully described in our columns, the author leaves the question of converting atmospheric nitrogen into nitric acid for the problem of obtaining compounds of an ammoniacal character. He deals in a few paragraphs with the experiments carried out by Wöhler, Deville, Marguerite, Sourdeval, Mond and Solvay, with the investigations by F. Siemens, Obach, Mehner and Schlutius, and he next undertakes a full description of the process worked out by Dr. A. Frank and Dr. N. Caro for the manufacture of calcium cyanamide. It will doubtless be remembered that, at the outset, this process was carried out upon

barium carbide, which, acted upon by nitrogen, gave a mixture of barium cyanide and barium cyanamide, *i.e.*, yielded combined nitrogen partly in the form of cyanogen and partly in a form closely related to that of ammonia. Moreover on fusing the product with sodium carbonate, the whole of the combined nitrogen could be recovered in the form of sodium cyanide, which could either be used as such in the various gold extraction processes now operated on a large scale, or converted into sodium ferrocyanide. A good deal of work on the process was carried out by the chemists of the Siemens & Halske A.G. which was primarily interested in the manufacture of cyanides. During the trials Pfleger and Freudenberg found that, if the conditions were slightly altered, the barium carbide used could be advantageously replaced by calcium carbide, the manufacture of which was at the time considerably easier and cheaper. It was also discovered that when calcium carbide was employed instead of the barium salt no cyanide was obtained, but only a pure cyanamide; and soon afterwards it was observed that the calcium cyanamide could be used as such in the state of powder as an artificial fertiliser for various crops in the place of Chile saltpetre. It was also seen that by treatment of the calcium cyanamide with superheated steam the nitrogen could be easily obtained in the form of ammonia, and that therefore it could be readily converted into ammonium sulphate which for some years past has been manufactured by the gasworks and also used as a fertiliser.

Thus the whole process assumed a somewhat different character, and became rather a method for obtaining cyanamide and ammonia than one for the production of the gold winners' cyanide. The change in tendency was emphasised by the Boer War, which seriously affected the demand for potassium cyanide in South Africa. Hence the experiments which had been carried out for some time on the premises of the Deutsche Gold und Silber Scheideanstalt, in Frankfort-am-Main, were continued by the Siemens & Halske Co., of Berlin.

At the time when this change came about the high price of calcium carbide was an obstacle to the successful exploitation of the process in its then form, and in consequence of the difficulties experienced a modified method was devised by the Siemens and Halske Co. in which nitrogen was brought into direct contact with a mixture of lime and powdered coke in an electric furnace, in order to obtain calcium cyanamide in one operation, instead, as formerly, of making carbide first and treating it with nitrogen afterwards.

The new process was patented by the Cyanide Co., of Berlin. It was carried out in a masonry furnace something like that used by Acheson in the United States, the furnace being about 20 ft. long, 10 ft. wide and 10 ft. high, provided with a jacket to conserve the heat, adjustable electrodes at either end, a tube for the admission of nitrogen into the jacket, and thence through numerous orifices in the inner walls, into the interior, and an escape pipe for the carbon monoxide. The furnace was of the resistance type, being brought into action by placing a thin rod of carbon between the ends of the electrodes. A certain measure of success had been obtained with this apparatus when the conditions of the carbide market so altered that it was found practically preferable to return to the old process invented by Frank and Caro. In the latter, powdered carbide obtained from the manufacturers was simply treated with atmospheric nitrogen in a combustion furnace. Under the supervision of Prof. Frank, Dr. A. R. Frank, Herr Voigt, Dr. Salzmann, and Dr. Erlwein himself, the old process was brought to a perfectly successful issue; and it was first worked on a commercial scale by the Società Italiana per la fabricazione di prodotti azotati e altre sostanze at Piano d'Orta in Italy. This factory has been built close to a works where carbide is manufactured, and it has since the beginning of 1906 been turning out calcium cyanamide at the rate of some 4,000 tons per annum, arrangements being made for increasing the capacity up to 20,000 tons per annum. Other factories for the manufacture of cyanamide have been built since then, or are still in process of construction, at Sebenico, on the River Kerka, in Dalmatia, at Briançon on the Lake of Geneva, at Martigny in the Rhone Valley, at a spot in the East of Germany, one in Norway, and one in America.

Two different processes are employed for obtaining the nitrogen required. In one a pair of vertical retorts made of refractory material and charged with copper are supported in the flame chamber of a combustion furnace; a current of air being led through them in order that the oxygen may be absorbed by the metal. In the other the nitrogen is prepared in a Linde apparatus in which air is liquefied by compression and cooling to − 194° C. and then allowed to volatilise in a plant resembling the fractionating column of a distillery. The carbide vessel consists of a horizontal retort fixed in a combustion furnace with doors at both ends. It is first fired up to a moderate temperature, charged with powdered carbide, and the furnace is then urged until the retort is red or white hot. In these conditions the carbide eagerly absorbs the introduced nitrogen, and since the process of making calcium cyanamide is exothermic, a good deal of heat is liberated and assists in the reaction. As soon as a meter on the gas main shows that the nitrogen is no longer being absorbed, the retort is quickly drawn, and the product is brought into closed receptacles where it can cool without coming into contact with air. When it is cold, the material is powdered and packed up ready for sale.

The cost of the calcium cyanamide is mainly dependent upon the price charged for carbide, which, in its turn, depends on the price of lime, coke and electrodes, and on the cost of electrical energy. Carbide factories working under normal conditions and free from excessive standing charges, which pay from 40 to 50 marks for their energy per H.P.-year, can supply carbide at such a price that it can be converted into calcium cyanamide and sold as such in competition with Chile saltpetre and ammonium sulphate, even if the latter fall considerably below the present market figures. This is particularly the case when the nitrogen is made by the Linde process, because on a large scale where current can be obtained at from 2 and 3 pfennige per KW.-hour, nitrogen can be procured from liquid air at a price of from 3 to 5 pfennige per cubic metre. A modern well conducted carbide factory turns out about 2 metric tons of carbide per KW.-year, and since this quantity of material absorbs about 500 kilogrammes of nitrogen in the form of calcium cyanamide, the fixation of one ton of nitrogen consumes about 2-KW.-years over and above the energy required in the preparation of the carbide. It is of interest to compare this figure with that representing the consumption of energy when atmospheric nitrogen is converted into nitric acid by the electric arc processes, for it would appear that the best results hitherto obtained show a consumption of roughly 6·4 KW.-years per ton of nitrogen entering into combination.

Calcium cyanamide, known in German commerce as "Kalkstickstoff," *i.e.*, lime-nitrogen, is a black powder permanent in air, frequently possessing a faint odour of phosphine, and containing about 57 per cent. of true calcium cyanamide, 14 per cent. of free carbon, 21 per cent. of calcium oxide, 2·5 per cent. of silica, 4 per cent. of ferric oxide, and small quantities of sulphur, phosphorus and carbonic acid combined with calcium. On an average it contains 20 per cent. of nitrogen. It passes into solution when placed in water, but decomposes, especially if the liquid is hot, calcium hydroxide being separated and a complicated body known as dicyandiamide being produced by polymerisation. Under the influence of superheated steam, calcium cyanamide gives up the whole of its nitrogen in the form of ammonia. If its aqueous solution is treated with acid, it yields under certain circumstances a series of very interesting organic bodies, among which urea may be mentioned. If melted with sodium carbonate, common salt or other flux, the whole of the nitrogen is converted into cyanide, and the melt consists of calcium cyanide, sodium cyanide, and the by-products from the decomposition of the flux employed.

Dr. Erlwein then describes the various experiments that have been carried out, and the results obtained by Wagner, Gerlach and others upon the use of calcium cyanamide as a fertiliser, all of which have been referred to in our columns on several former occasions. He also describes an apparatus used experimentally for the preparation of ammonium sulphate of such capacity that one ton can be treated per day. The apparatus consists of a vertical perforated metal cylinder contained in an iron receptacle of similar shape, surrounded with brick work. The calcium cyanamide is placed in the inner vessel, superheated steam is led into the annulus, and the ammonia vapours so produced are led into a vessel charged with strong sulphuric acid, and constructed something like the simplest form of saturator used by the gas makers. The dicyandiamide already mentioned is a body forming large white crystals, and is employed in the manufacture of aniline dyes and of explosives. The crude sodium cyanide which can also be prepared, contains 22 or 23 per cent. of the pure salt, corresponding with 30 per cent. of potassium cyanide. It can either be sold as such to the gold industry, and employed in the treatment of tailings and slimes, or it can be worked up by distillation into a pure white cyanide of sodium or of potassium. Recently calcium cyanamide has found a new employment as a hardening material for iron and steel. It has been sold for a short time under the name of "ferrodur" for this purpose, and has been reported on favourably by Dr. Reininger, head chemist at the Ludwig-Loewe machinery works, and others. The substance is said to act in an unusually uniform manner at a temperature at which uniform carburisation of iron has hitherto been exceedingly difficult.

Dr. Erlwein brings his article to a conclusion by presenting numerous curves showing the consumption of Chile saltpetre and ammonium sulphate in the world and in various individual countries since 1830. It would appear that the exportation of the former from Chile has risen from about 30,000 tons in 1850, to about 1,300,000 tons in 1904; and also that the consumption of saltpetre in Germany, which was approximately 352,000 tons, valued at 63 million marks in 1893, has increased to about 475,000 tons with a value of, roughly, 90 million marks in 1904. Similarly, the consumption of ammonium sulphate in Germany has risen from 96,000 tons, valued at 17 million marks in 1898, to 172,000 tons, valued at 43 million marks in 1904. The amount of potassium cyanide exported from Germany was 18 tons, valued at 50,000 marks in 1886, but had risen to 4,000 tons, valued at 4·3 million marks in 1905. At the time of his article, the cost of one kilogramme of nitrogen combined in the form of 98 per cent. potassium cyanide was from 6·5 to 8·5 marks; in that of nitric acid having a specific gravity of 1·31 was about 3 marks; in that of agricultural Chile saltpetre was about 1·2 to 1·5 marks, and in that of grey 24 per cent. ammonium sulphate was 1·2 to 1·3 marks. These figures show that processes for the fixation of atmospheric nitrogen may be economically successful, even if it should ultimately prove to be altogether impossible to compete with the cheap artificial fertilisers of the present day.

A Darlington Contract Dispute.—The *Manchester Guardian* says that at last week's meeting of the Darlington T.C. it was reported that Mr. Wooler (chairman), Alderman J. J. Wilkes and the Town Clerk had been deputed to deal with the British Electric Equipment Co., who had delayed in completing their contract. The company had started an action against the Corporation for £1,430, but this the committee had been able to stop, and had entered into arrangements whereby the Corporation paid £300 in full settlement of the claim and costs, which the committee considered a satisfactory conclusion to the business.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

1907.

2,364A/06. "Improvements connected with electric motors for varying the speed and simultaneously maintaining a constant electromotive force." M. W. W. Mackie. (Date applied for under Rule 5 of the Patents Rules, 1905, January 30th, 1906.) February 1st.

2,064. "New shade-holder for electric lamps." A. H. Russell. January 28th.

2,121. "Improvements in electrical fuse-boxes." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. January 28th.

2,123. "Improvements in the manufacture of incandescence filaments for electric lamps from metallic thorium containing exide with or without admixtures of other difficultly fusible metal." Siemens & Halske Akt.-Ges. (Date applied for under Patents Act, 1901, March 29th, 1906, being date of application in Germany.) January 28th. (Complete.)

2,138. "Improvements in and relating to brush-holders for dynamo-electric machines." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) January 28th.

2,150. "Improved arrangement of electrical circuits which comprise an induction coil, especially applicable to the ignition circuits of automobile engines." S. J. Watson and The Westlake Motor Syndicate, Ltd. January 28th.

2,154. "Improvements in and relating to electrical switch and like casings." A. Barnes and Drake & Gorham, Ltd. January 28th.

2,160. "Improvements in or connected with sparking mechanism for explosion engines." L. A. Gianoli. (Date applied for under Patents Acts, 1901, January 29th, 1906, being date of application in France.) January 28th. (Complete.)

2,202. "Improvements relating to commutators or collectors for use in electric dynamos and the like." Akt.-Ges. Brown, Boveri & Cie. (Date applied for under Patents Act 1901, February 2nd, 1906, being date of application in Germany.) January 29th. (Complete.)

2,227. "Improvements in or relating to over-load circuit breakers." Siemens Bros.' Dynamo Works, Ltd., and C. R. Palairet. January 29th.

2,228. "Electrical resistance computing scale." C. G. G. Thomas. January 29th.

2,247. "Improvements in electric foot-warmers." J. W. Ewart. January 29th.

2,281. "Improvements in or relating to electrically operated alarms." B. Kohlen. January 29th. (Complete.)

2,283. "Improvements in and relating to coherers for wireless telegraphy." A. Muirhead. January 29th.

2,377. "Process of improving the magnetic qualities of a magnetic body." R. A. Hadfield. (Date applied for under Patents Act, 1901, July 5th, 19.6 being date of application in U.S.) January 30th. (Complete.)

2,383. "Improvements in and relating to electric contact make-and-break devices." R. O. Mitchell. January 30th.

2,393. "Improvements in and relating to releasing devices for automatic electric circuit-breakers." British Thomson-Houston Co., Ltd., E. B. Wedmore and J. Whitcher. January 30th.

2,394. "Improvements in and relating to electric heaters." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) January 30th.

2,413. "Improved electrical block signalling system for railways." G. H. Brown. January 31st.

2,416. "Improvements relating to alternating-current instruments and appliances employed therewith." W. E. Sumpner. January 31st.

2,417. "Improvements in electrical switches." J. H. Chambers and P. F. B. Bennett. January 31st.

2,459. "Improvements in dynamo-electric machines." M. Walker. January 31st.

2,492. "Improvements in electric telegraphs." E. W. Beech. January 31st.

2,494. "Improvements in commutator brushes, bearings and the like." The Morgan Crucible Co., and C. D. McCourt. January 31st.

2,495. "Improvements in the manufacture of compositions or compounds for commutator brushes, bearings and the like." The Morgan Crucible Co., Ltd., and C. D. McCourt. January 31st.

2,499. "Improvements in automatic telephone exchanges operating with electro-magnetically controlled selecting devices." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) January 31st. (Complete.)

2,507. "Improvements in means for carrying the insulators of overhead electric conductor supports." P. Dawson. January 31st.

2,508. "Improved means for supporting the insulators of overhead electric conductor carriers." P. Dawson. January 31st.

2,509. "Improvements in and relating to ignition arrangements for internal combustion engines and purposes." H. A. Humphrey. January 31st.

2,515. "Improvements in forms for making fibre insulating coverings." W. H. Baker. (Date applied for under Patents Act, 1901, March 21st, 1906, being date of application in United States.) January 31st. (Complete.)

2,516. "Improvements in insulating coverings or sheathing for contact rail conductors." W. H. Baker. January 31st. (Complete.)

2,522. "Improvements in holders for electric lamps and shades." J. A. Gosling. January 31st. (Complete.)

2,524. "Improvements in incandescent electric lamps." W. J. Addison. February 1st.

2,538. "Improvements in devices for supporting electric, gas or other lamps." W. B. Scott. February 1st.

2,540. "Improved method of lighting vehicles electrically." J. H. Ross. February 1st.

2,551. "Improvements in and relating to arrangement for indicating and recording permanently the maximum demand for electrical energy on any circuit." W. W. Lackie and D. J. Steele. February 1st. (Complete.)

2,555. "Improvements in trolleys and trolley-wheel for overhead systems of electric cars and like purposes." J. S. Hilton and A. Dawson. February 1st. (Complete.)

2,570. "New or improved method of and apparatus for extruding lead or like pipes as a covering for cables or the like." A. W. Wylie and J. Wilson. February 1st.

2,571. "Improvements in electric cells or batteries." W. Moores and G. Petrides. February 1st.

2,587. "Improvements in arc lamps." A. Howard. February 1st.

2,588. "Improvements in dynamo-electric driving and change speed or differential gear." M. Albrecht. (Date applied for under Patents Act, 1901, February 1st, 1906, being date of application in Germany.) February 1st. (Complete.)

2,595. "Improvements in dynamo-electric machines." Ateliers Thomson-Houston (Anciens Etablissements Postel-Vinay). (Date applied for under Patents Act, 1901, February 2nd, 1906, being date of application in France.) February 1st. (Complete.)

2,604. "Improvements relating to electric time-switches." J. Cauderay. (Date applied for under Patents Act, 1901, February 6th, 1906, being date of application in Switzerland.) February 1st. (Complete.)

2,613. "Improvements in electrical maximum demand or rebate indicators." H. S. Hatfield and The Reason Manufacturing Co., Ltd. February 1st. (Complete.)

2,639. "Improvements in driving gear for electric motors, lifts and the like." H. Hill and R. Hacking. February 2nd.

2,652. "Improvements in secondary batteries, plating baths and the like." H. F. Joel. February 2nd.

2,660. "Improvements in sectional conductor systems of electric railways." J. Reed and J. Hymers. February 2nd.

2,675. "Improvements relating to insulated electric conductors." J. Connolly. February 2nd.

2,677. "Improvements in connection with alternating current commutator electric motors for increasing the starting torque thereof." Felten and Guilleaume-Lahmeyerwerke Act.-Ges. (Date applied for under Patents Act, 1901, Febuary 3rd, 1906, being date of application in Germany.) February 2nd. (Complete.)

2,687. "Improvements in or relating to the electrical transmission of power." Siemens Bros.' Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) February 2nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

Application of Rotary Electric Motors to work certain to-and-fro Movements, and in a Gearing Device, and a Pump, and a Fluid Motor, with which the same can be effected. G. H. H. Hardy. 20,819. October 14th.

Process for the Coating of Metallic Surfaces with Electric Insulation. C. W. Atkinson. 892. January 12th.

Means for Preventing Overheating of Electrical Machinery. C. A. Parsons. 1,068. January 15th.

Electric Cables. J. E. Kingsbury. (Western Electric Co.) 1,389. January 18th.

Systems of Laying Electric Conductors. J. S. Highfield. 1,944. January 25th.

Electric Flash or Pocket Lamps. W. Thomson. 2,956. February 7th.

New Electrolytic Process for the Treatment of Copper Ores and Copper Waste for the Recovery of Pure Copper. L. M. Lafontaine. 2,989. February 7th.

Electrical Transformers. British Thomson-Houston Co. (General Electric Co.) 6,316. March 15th.

Safety Footboard for Electric Railway Carriages. L. Mortelmans. 9,737. April 26th.

Circuit Closing Device for Electric Clocks. C. Schwan. 10,283. May 2nd. (Rights under Patents, &c., Act, 1901, not granted.)

Electric Meters. G. Fery and E. Grassot. 10,861. May 9th.

Controlling Gear for Electrically Driven Pumps. Hugh Smith & Co., H. Smith and O. Smith. 13,313. June 9th.

Trolley Heads for Electric Tramways. H. Peace. 13,358. June 11th.

Ignition Apparatus for Internal Combustion Engines. L. K. Leahy. 16,916. July 26th. (Date applied for under International Convention, August 17th, 1905.)

Electrical Sterilising Apparatus. Felten, Guilleaume-Lahmeyerwerke Akt.-Ges. 17,342. August 1st. (Date applied for under International Convention, August 1st, 1905.)

Controlling Single-Phase Commutator Electric Motors, also Applicable to Three-Phase Commutator Motors. Siemens Bros.' Dynamo Works. (Siemens Schuckertwerke.) 17,911. August 9th.

Arrangement of Electric Motor-Generator for Working Arc Lamps. Siemens Bros.' Dynamo Works. (Siemens Schuckertwerke.) 21,094. September 22nd.

Coin-Freed Apparatus for Administering Electricity. W. A. A. Fricke and A. W. K. Witte. 24,156. October 30th.

1906.

Controlling Devices for Electric Motors. British Thomson-Houston Co. (General Electric Co.) 290. January 4th.

Electrical Signalling on Railways. E. R. E. Rotter. 535. January 8th.

Attachments for Electric Incandescent Lamp Clusters. J. H. Fairweather. (Benjamin Electric Manufacturing Co.) 689. January 10th.

Controlling Devices for Electric Motors. British Thomson-Houston Co. and J. Sugden. 725. January 10th.

Means for Connecting Flexible Metallic Tubing to Gas, Air, Fluid, or Electric Fittings. S. Quincey and C. Harrison. 789. January 11th.

Automatic Electric Switching Apparatus. L. K. Job. 894. January 12th.

Telephone Circuits. C. M. Jacobs and W. J. Thorrowgood. 997. January 13th.

Telephonic Apparatus. E. A. Graham. 1,713. January 23rd.

Signalling Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 2,064. January 26th.

Rotating Magnets for Dynamo-Electric Machines. C. A. Parsons, C. G. Stoney and A. H. Law. 2,151. January 27th.

Electrical Fuse Boxes. E. G. Anness and C. W. Denny. 2,777. February 5th.

Manufacture of Incandescing Bodies for Electric Incandescent Lamps. A. Just, F. Hanaman, H. Lande-berger Salzmann and Vereinigte Electricitäts Akt.-Ges. 3,225. February 9th.

Means for Controlling the Admission of Gas to, and the Ignition of, Internal Combustion Engines of Motor Vehicles and Boats. A. J. Clay. 4,133. February 20th.

Dynamo-Electric Machines. H. H. Ralston. 4,489. February 23rd. (Date applied for under International Convention, March 1st, 1905.)

Dies for Forming Accumulator Plates. A. J. Blanchon. 4,510. February 23rd. (Date applied for under International Convention, February 24th, 1905.)

Means for Regulating Asynchronous Electric Motors. Elektricitäts Akt.-Ges. vorm. W. Lahmeyer & Co. 5,153. March 2nd. (Date applied for under International Convention, March 18th, 1905.)

Reels for Electric Conductors for Lamps, Telephones and the like. A. St. V. Burnaby. 8,002. April 3rd.

Electro-Deposition of Copper and other Metals. S. O. Cowper-Coles. 8,924. April 12th.

Electrically-heated Irons. H. J. Read. 9,244. April 19th.

Electric Controller Contact. W. McCormick. 9,550. April 21th.